INTERAVIA

REVIEW OF WORLD AVIATION

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Medium-Haul Transport

— Today and Tomorrow —

VOLUME IX 5 1954

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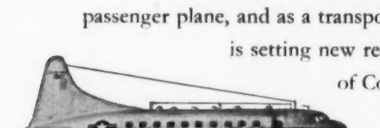

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INTERAVIA

Review of World Aviation

Volume IX — No. 5 — 1954

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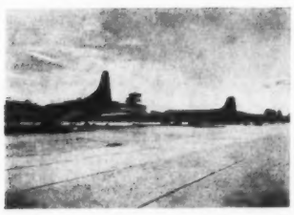

Front Cover .

The Far East Conference in Geneva

View of Geneva-Cointrin Airport, with medium-range aircraft in the foreground.

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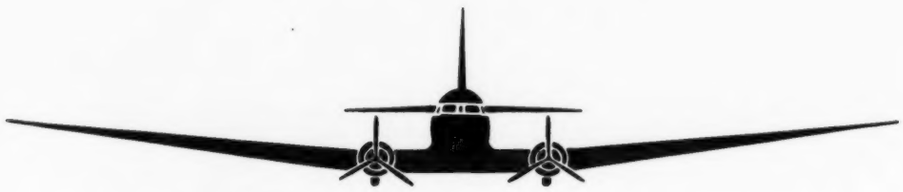

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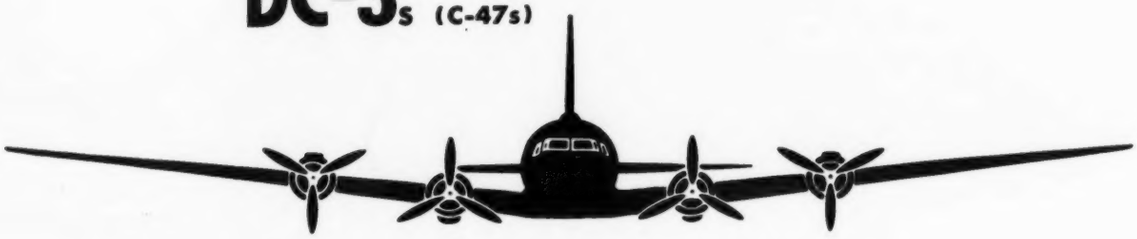

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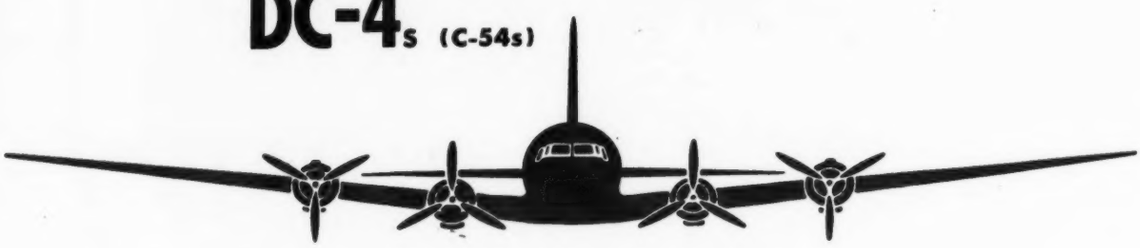

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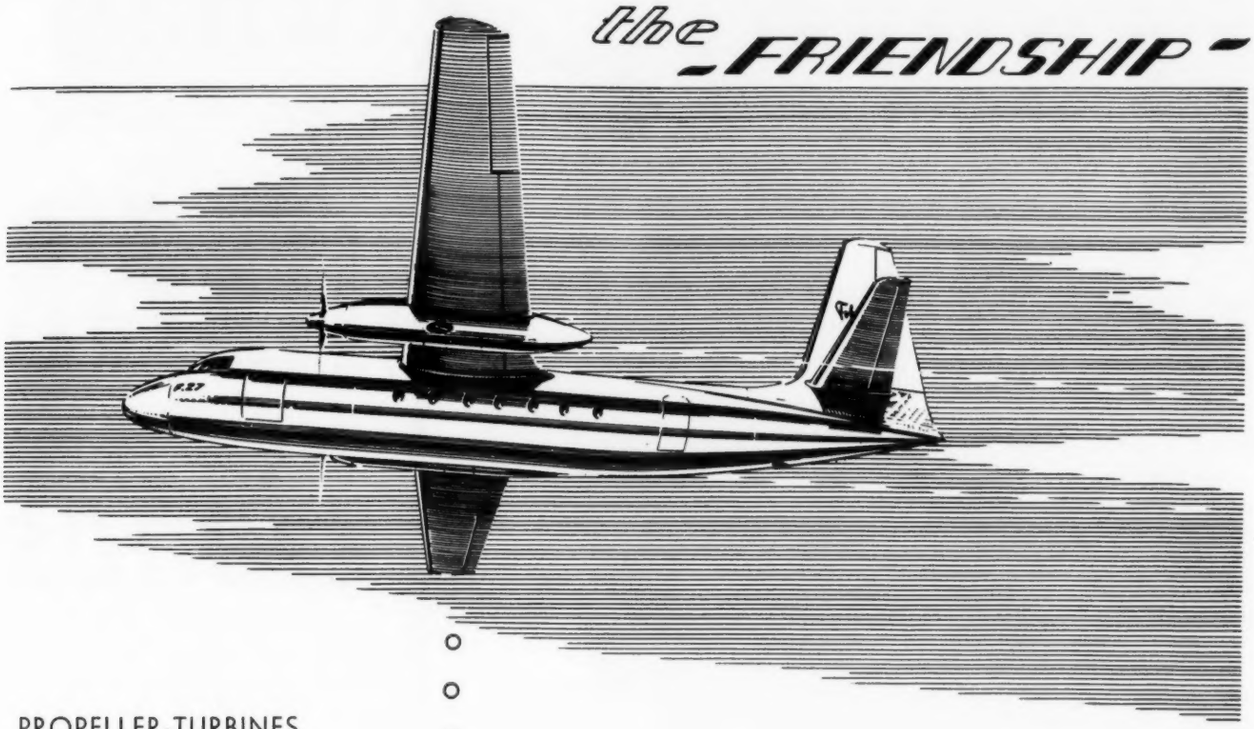

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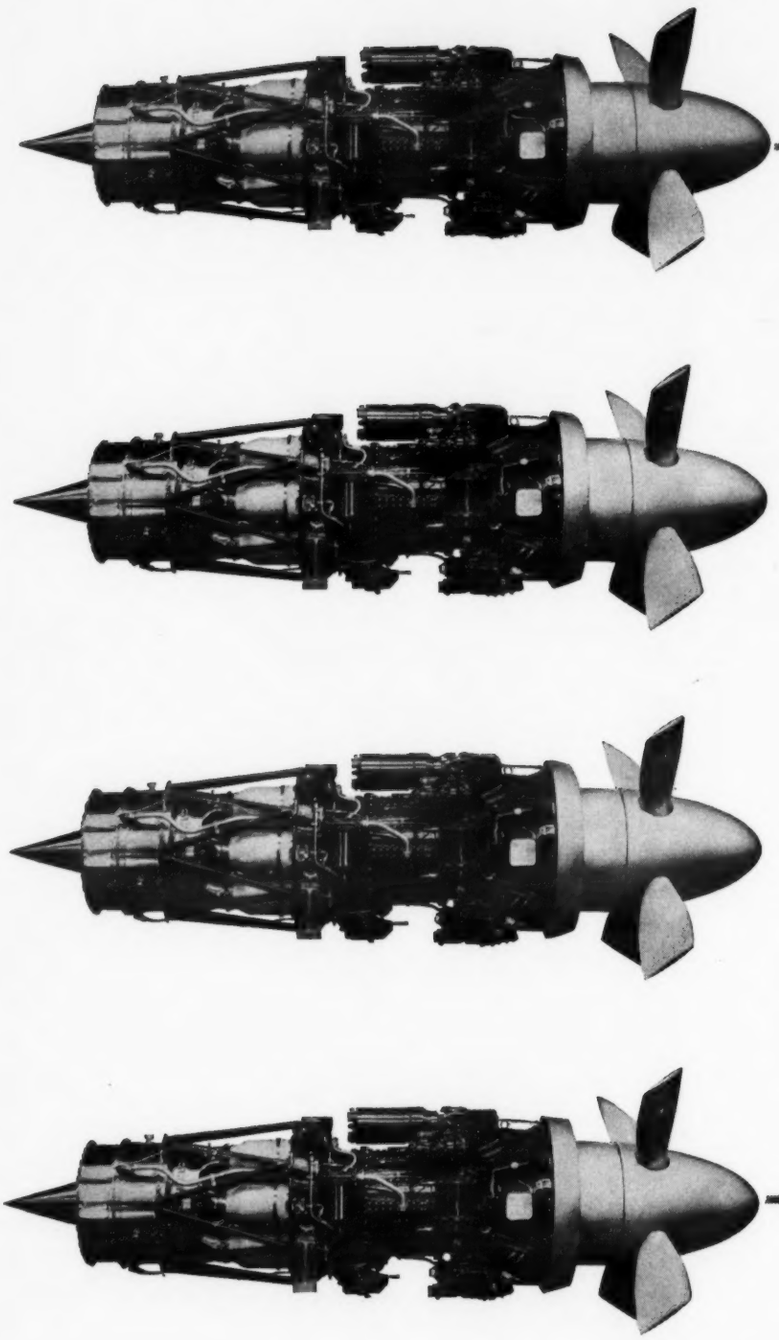

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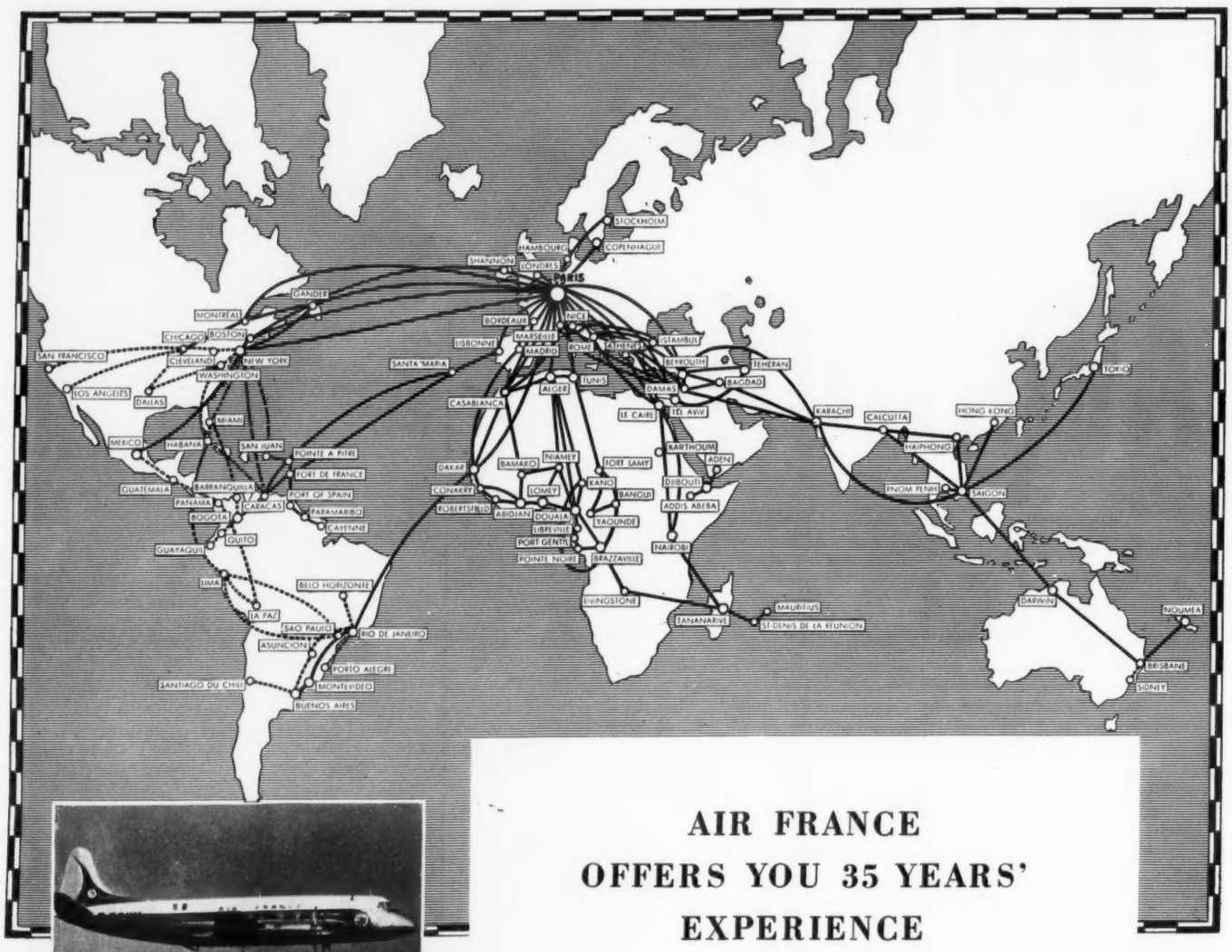

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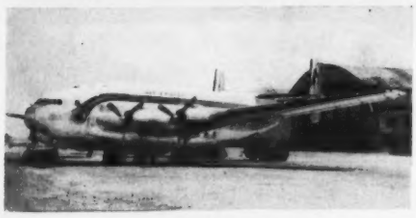

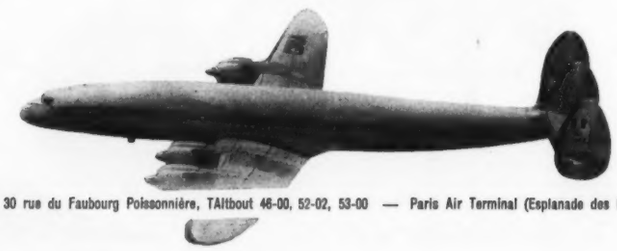

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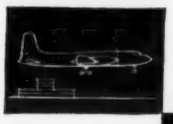
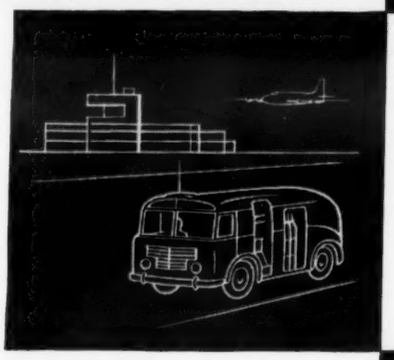


50 watt VHF TRANSMITTER

PTC 351 FOR GROUND-TO-AIR CONTROL



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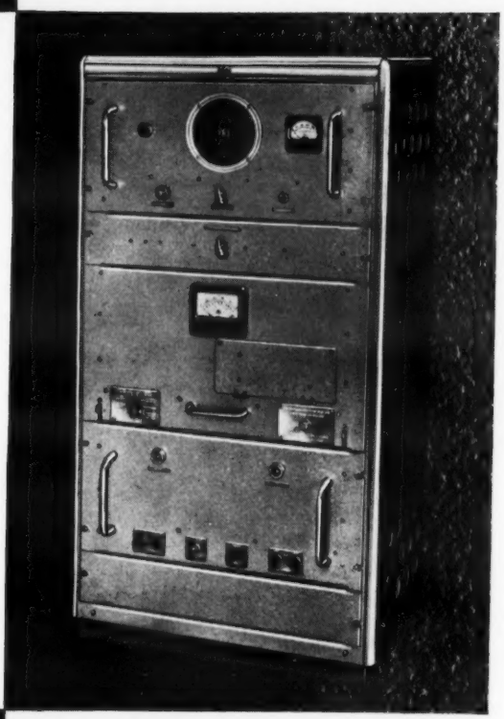

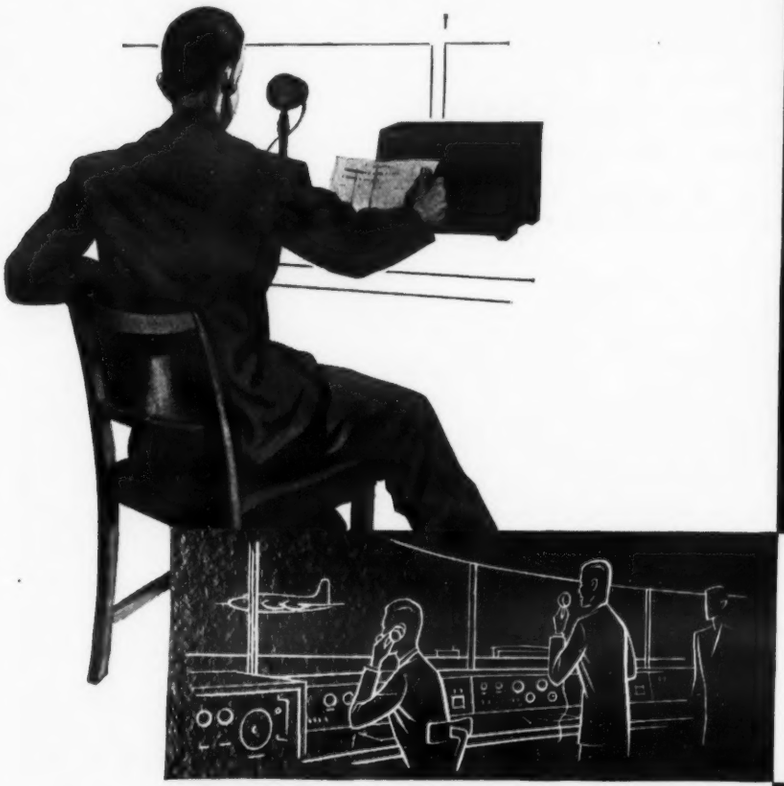

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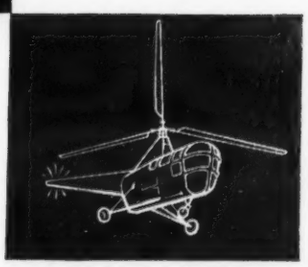

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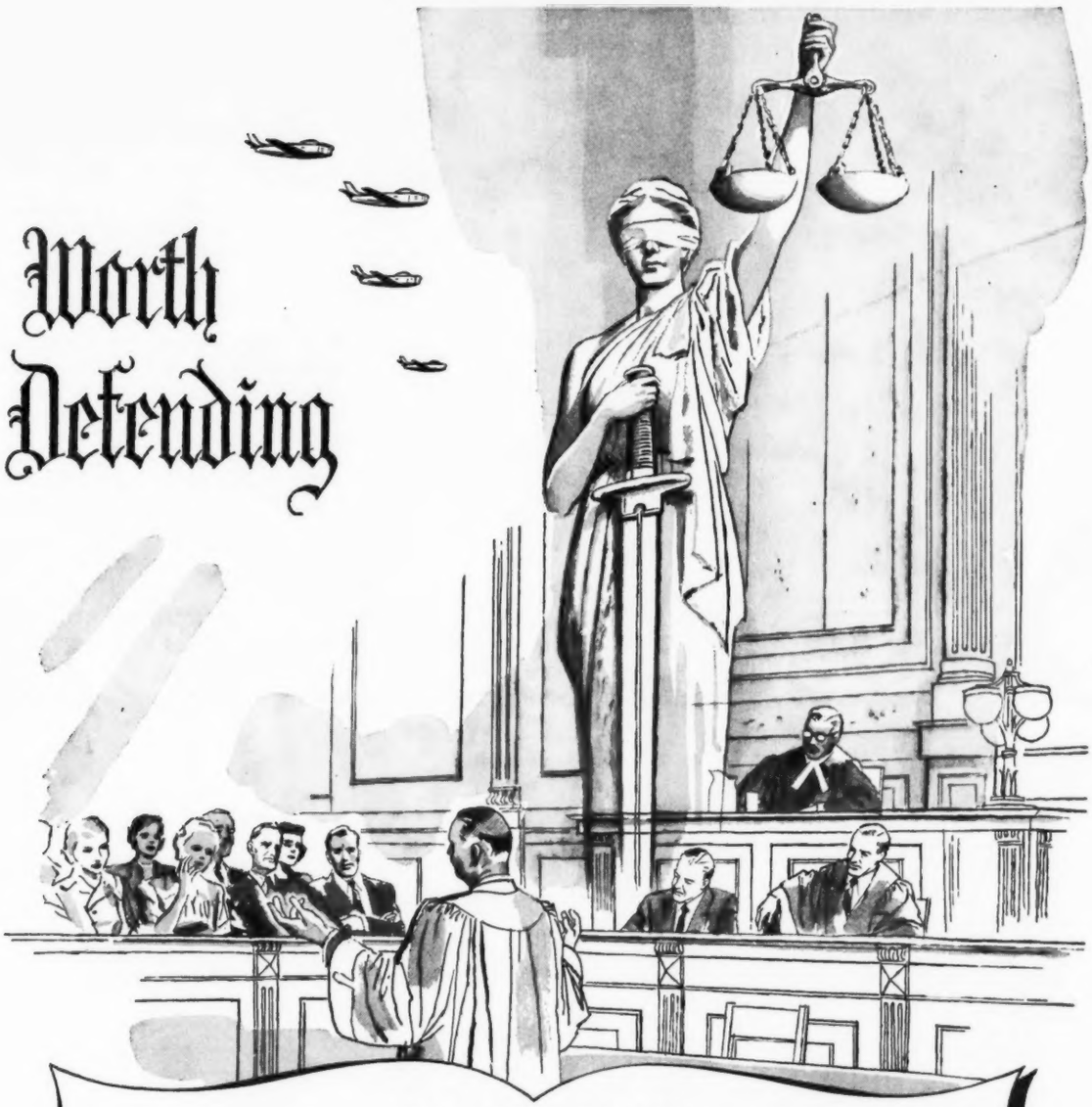

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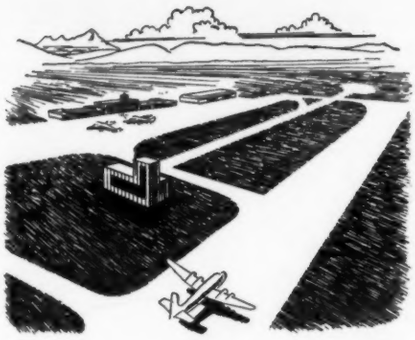

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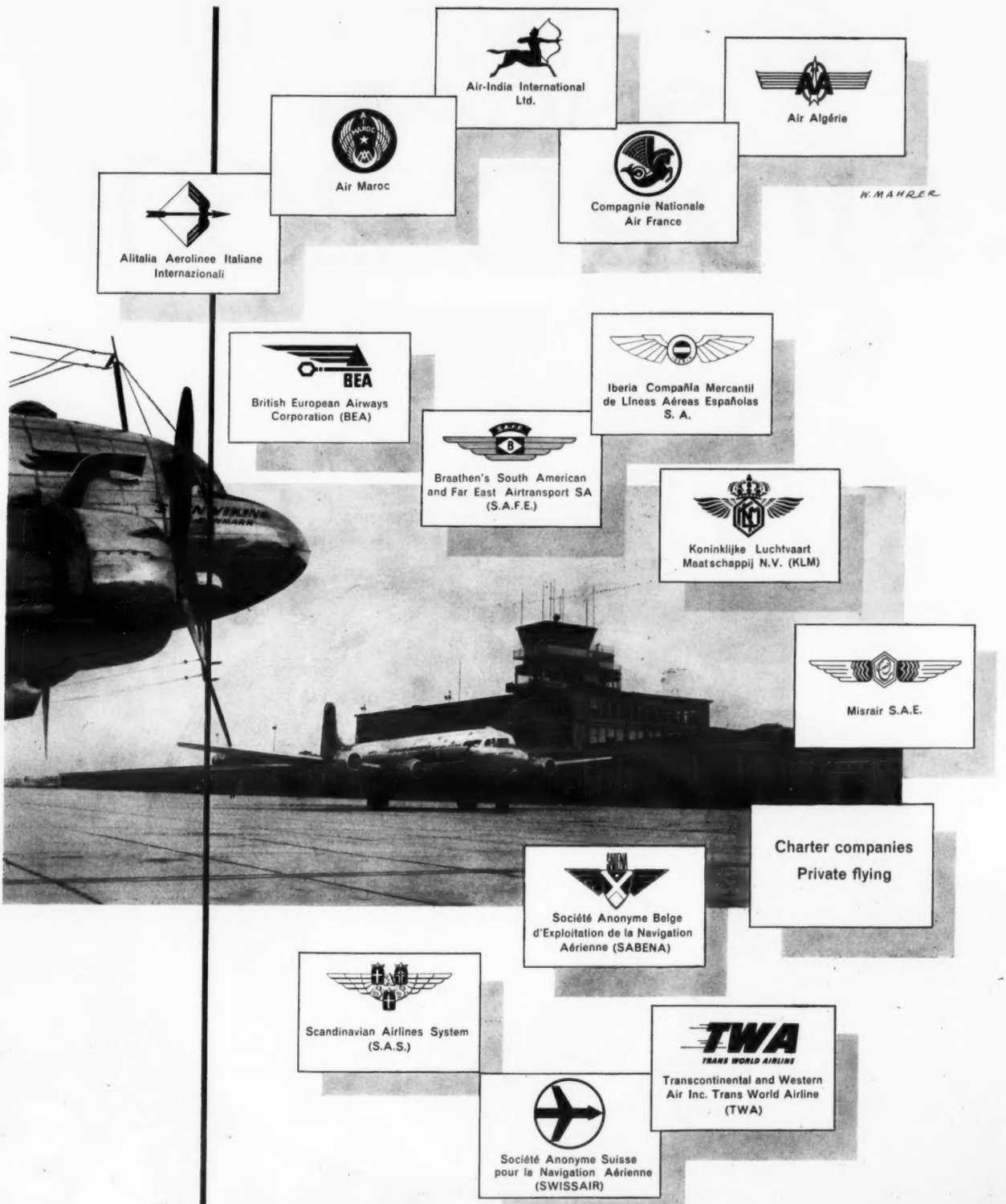
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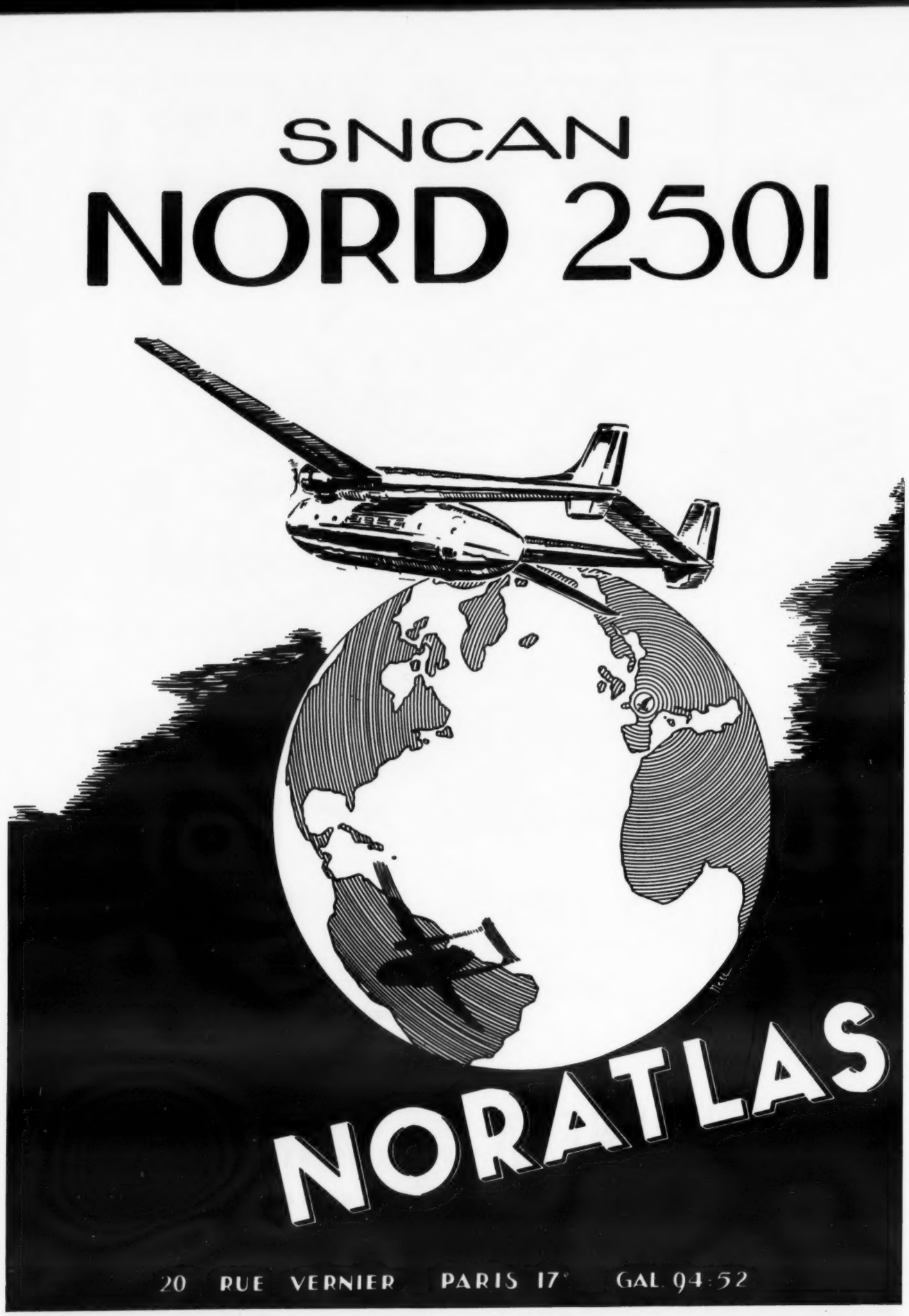
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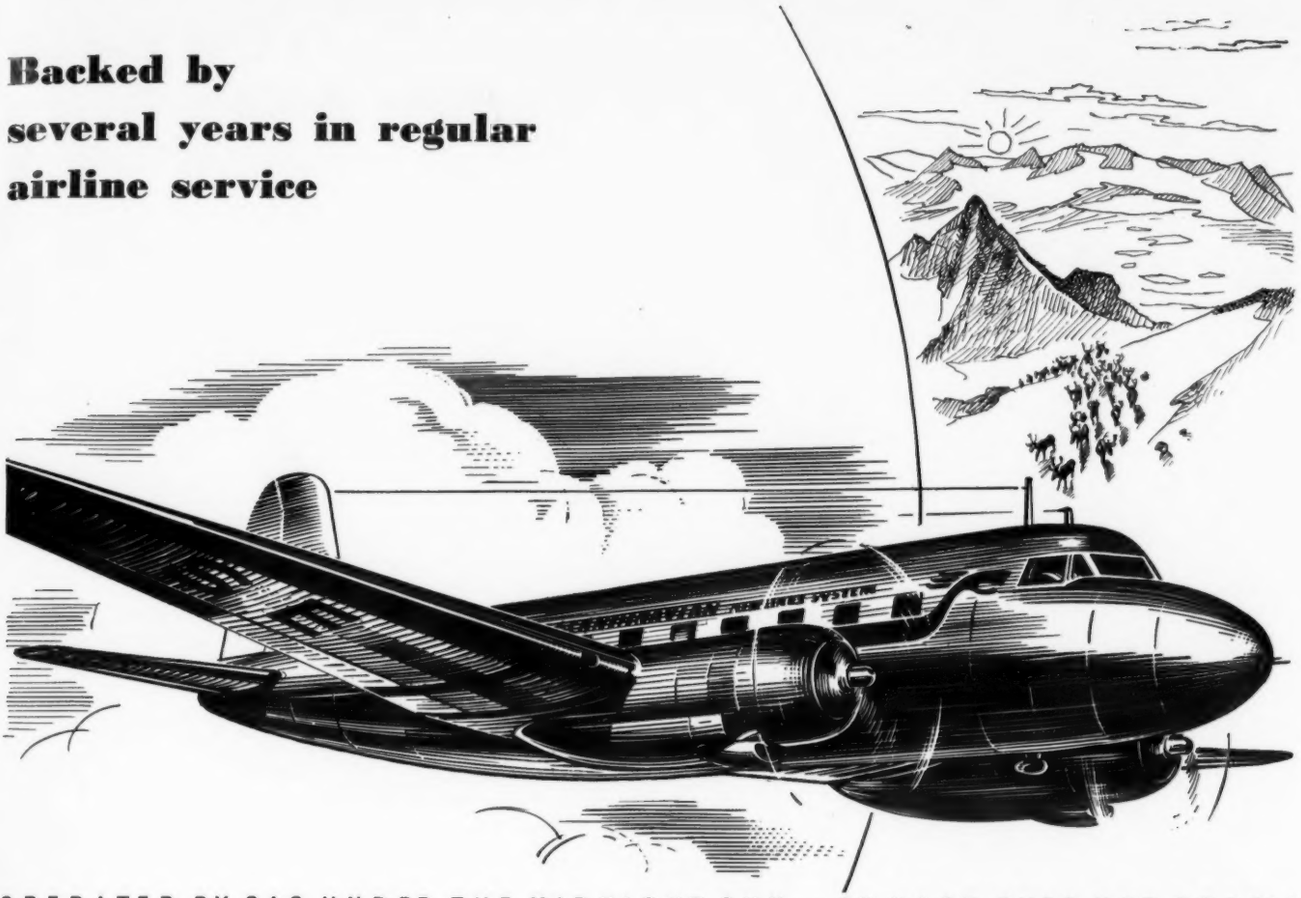
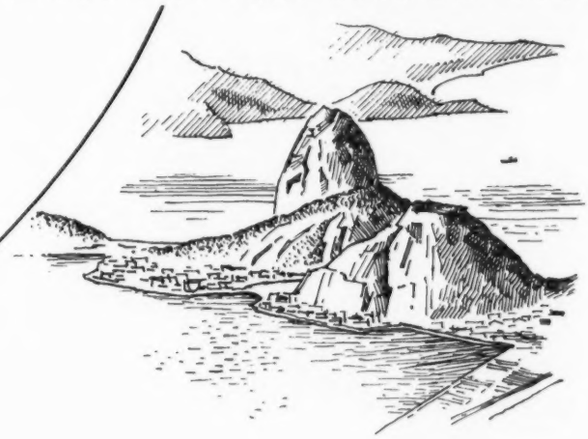


OPERATED BY SAS UNDER THE MIDNIGHT SUN — BY VASP OVER HOT BRAZIL



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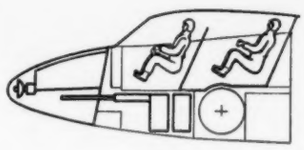
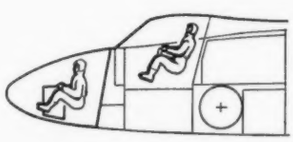


All-weather fighter

Ground attacker



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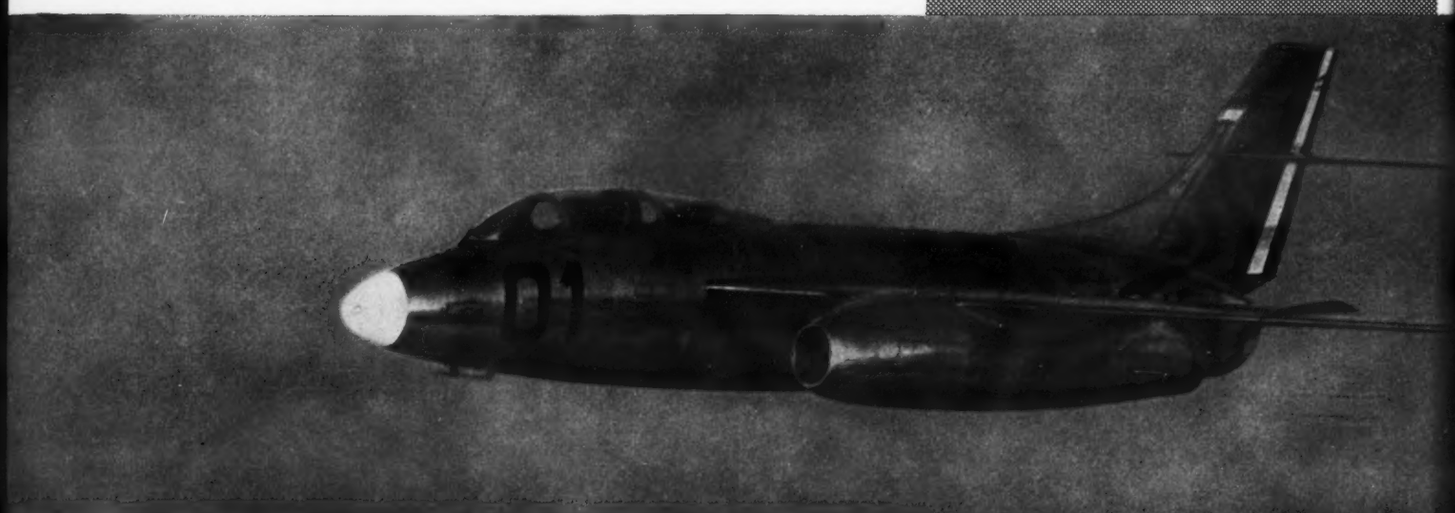

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INTERAVIA

Deadline Notes

No. 5, 1954.

I.C.A.O. COUNCIL DECISIONS

Decisions taken by the Council of the International Civil Aviation Organization at its 21st Session include: a) to circulate a guide to airport authorities for fixing airport charges; b) to hold a conference in Holland in September 1955 to discuss amendment of the Warsaw Convention; c) to hold the Third North Atlantic Regional Air Navigation Meeting in Montreal on October 5th, 1954; d) to move the Far East and Pacific Office from Melbourne to Bangkok towards the end of the year; e) to organize the fourth meeting of the Facilitations Committee early in 1955.

W.M.O.'s AERO-METEOROLOGICAL COMMISSION

The First Session of the World Meteorological Organization's Commission for Aeronautical Meteorology is to be opened in Montreal on June 15th, 1954. The Meteorological Division of the International Civil Aviation Organization will also meet in Montreal at the same time.

U.S.-CANADIAN RADAR NETWORK

Survey work for a new Canadian-United States radar warning network in the far North of the American continent is well advanced, according to U.S. Defense Secretary Charles E. Wilson. The new system is to be located north of the "Pine Tree Chain" begun four years ago. - Of the $896,976,600 applied for this year for military construction by the Defense Department, $110,325,000 is for radar and other continental air defence measures.

N.A.T.O. TRAINING CENTRE AT FUERSTENFELDBRUCK

The North Atlantic Treaty Organization's first pilot training school in Europe has been opened at Fürstenfeldbruck, near Munich. The new centre will train instructors, who will later train pilots of Western European air forces in the latest flying equipment.

U.S. AIR FORCE ACADEMY

President Eisenhower has signed the Congressional Act creating an Air Force Academy, equivalent to the Army's West Point and the Navy's Annapolis. The U.S.A.F. has thus won its long struggle for its own academy. Air Force Secretary Harold E. Talbott is appointing a commission to decide on a location for the new academy.

IN-FLIGHT REFUELLING FOR CIVIL TRANSPORTS ?

An American firm has announced plans for the in-flight refuelling of civil airline transports, according to a Reuter report from Washington. The firm is said to have already applied to the U.S. Government for permission to operate from bases in the United States over the North Atlantic.

INSTALMENT PLAN FOR AIR TRAVEL

The "Pay Later" plan for air travel initiated by Pan American World Airways and its subsidiaries and hitherto available for travel from the United States only, has now been extended to roughly 1,500 P.A.A. agencies throughout the world. A down payment of 10% of the fare is required, the remainder being paid off in 20 monthly instalments. The Beneficial Loan System is to cooperate with P.A.A. in operating the plan.

B.O.A.C. SUSPENDS SOUTH AMERICAN SERVICES

British Overseas Airways Corp. has suspended all operations to South America until further notice, as the Canadair-Four Argonauts used on this route are required for the services hitherto operated by the de Havilland Comets, now grounded. Bookings have been offered to other airlines.

* From INTERAVIA's world-wide news service, including INTERAVIA AIR LETTER, the daily international aviation news digest. — No part may be reproduced without written permission.

DOLLAR LOAN FOR J.A.L.

Japan Air Lines has received authorization from the Japanese Finance Ministry to take up a one-year $3,000,000 loan from three American banks, to enable it to buy additional Douglas DC-6Bs.

FOKKER-DE SCHELDE MERGER

Interavia's Amsterdam correspondent reports that the aircraft division of the N.V. Koninklijke Maatschappij De Schelde, of Dordrecht, is to be taken over by Fokker on May 1st. This would leave Aviolanda as the only independent aircraft firm outside Fokker, since Avio Diepen (Frits J.L. Diepen) was bought up by Fokker in February. The De Schelde works, now occupied with the licence production of Saab 91B Safir trainers, are to begin building the British Hawker Hunter jet fighter.

U.S.A. DEVELOPING ATOMIC POWER PLANT FOR AIRCRAFT

The news comes from Washington as something of a surprise that an atom-powered aircraft is under construction, despite the fact that it was announced a short time ago that the 1946 plan for atomic power plant had been postponed for an indefinite period (at least 10 years). The airframe is being built for the U.S. Air Force by Convair's Fort Worth plant, Texas, while the reactor, ordered jointly by the Air Force and the Atomic Energy Commission, is under construction by General Electric. Research contracts have also been placed with Boeing Airplane Co., Pratt & Whitney Aircraft Division of United Aircraft Corp. and Lockheed Aircraft Corp.

SHORTS CANCEL COMET 2 PRODUCTION

On April 16th Short Bros. & Harland of Belfast announced that they were stopping work on the de Havilland Comet Mk.2 jet airliner, Shorts said that they would complete only the prototype Mk.2 which is due to come off the assembly line in August. Short Bros. & Harland were the second of three Comet production facilities set up in the United Kingdom.

*

WORKSHOP BRIEFS

A fourth prototype of the Gloster Javelin twin-jet all-weather fighter is undergoing flight testing. It differs from earlier prototypes in its modified wing unit, which has its leading edge slightly bent forward at about half span, and blunter wing tips. * The Bristol 173 twin-engined helicopter is being developed as an anti-submarine aircraft for use by the Royal Navy. * A model of the SE.210 Caravelle jet transport made by the French S.N.C.A. du Sud-Est is to be tested this summer in the large wind tunnel at Cornell Aeronautical Laboratory. * Lockheed RT-33 is a single-seat reconnaissance version of the two-seat T-33 fighter trainer: four cameras in the nose; little change in main dimensions; range about 20% greater. * A second North American TF-86 jet trainer is being built, to replace the first prototype lost in an accident. * The A3F rocket projectile developed by the Argentine Government aircraft firm, I.A.M.E. recently underwent first tests. Use against tanks, trucks, small ships etc. * The four-jet Boeing Stratotanker is to be ready for ground tests by the end of June or beginning of July. First flight planned for August. * Details of a number of American small helicopters (single-seat models with piston engines, pulse-jets or ramjets) are expected to be announced shortly. For example, Hiller is believed to have an ultra-light one-man helicopter with piston engine under development. * Yugoslav press reports indicate that the Turboméca Palas small turbojet engine is now being built under licence in Yugoslavia. Two aircraft of Yugoslav design have already been fitted with Palas engines. * The two Northrop X-4 experimental aircraft have been withdrawn from service, having completed their research programme. - The Convair XF-92A, forerunner of the Convair F-102A delta-wing fighter, has also been withdrawn. * Wolfgang Assmann GmbH, Bad Homburg, Germany, makes multi-channel magnetic tape recorders for airports, in two main versions: up to 14 channels, and up to 4 channels. One channel is normally used to record time readings. * "Termenol" is a new heat-resistant alloy developed at the U.S. Naval Ordnance Laboratories, which is about 25% lighter than stainless steel; high tensile strength; non-sensitive to corrosion and oxydization. - Composition: "Alfenol 16" alloy plus 16% Al plus Fe with addition of V or Mo. * A four-seat touring aircraft with two 150 h.p. Lycoming engines, built by Monocoupe Aircraft, Melbourne, Florida, is shortly to undergo C.A.A. certification tests. * Parts production for the Hurel-Dubois HD.45 twin-jet airliner has begun.

* * *

Medium-Stage Air Transport

Medium-haul operators are seeking new roads–or, to be more exact, new equipment to enable new routes to be flown.

The difficulty begins with the definition of the term. What is medium-stage transport, what are medium stages? A British expert calls "shorter ranges" distances between 200 and 1,000 miles, and "longer ranges" between 1,000 and 1,800 miles. The margin should be wide enough . . . The good old Douglas DC-3 has been used during its life on routes of all lengths, where necessary with intermediate landings. And has proved a universal standby.

Now that it has been decided to pension off the DC-3, it appears that it is no longer possible to find a "standard type" for all medium-stage duties. In fact, a general survey shows that at least 26 medium-range models have been proposed for the period 1946 to 1958. Some have not been followed up, others are flying today, still others will be ready tomorrow. These types have very different classes of power plant: piston engines, turboprops, even pure jets.

One thing emerges fairly clearly. There is a certain amount of confusion on the medium-stage aircraft market today.

*

Quantitatively, medium-range transport is still dominated by the Douglas DC-3. However, the bigger and financially stronger airlines now hesitate to offer their passengers a twenty-year-old aircraft whose speed no longer meets modern standards. On the other hand, it would be extravagant to use heavy four-engined types. That would be like running long-distance buses, complete with kitchens, washrooms and toilets, between Piccadilly Circus and Hyde Park Corner, or between the Arc de Triomphe and the Opéra.

A replacement for the DC-3 which appeared in 1947 was the Convair 240, which was long regarded as the "dernier cri". How many hidden snags there are in the design and production even of a twin-engined airliner is reflected, for example, in the balance sheets of The Glenn L. Martin Co. after the production of about 50 Martin 2-0-2s and 100 Martin 4-0-4s, and even of the more powerful Consolidated Vultee Corp. after the delivery of the first 175 Convair 240s. Bought straight off the drawing board, subjected to modifications and special customer requirements, they are said to have resulted in an initial loss of $50,000,000. Later Convair recognized that the future would belong to the propeller turbine aircraft in the medium-stage field, and worked out a project for a bigger *Convair Liner 340* with two powerful turboprops.

"British gain ground in aircraft markets," said Frank D. Sinclair, Convair's Director of Foreign Sales, in an interview with "The San Diego Union" on December 6th, 1953. "We're not competing against Vickers for this market. We're up against the entire British Empire." He added that the *Viscount* sales campaign was being conducted not only by Vickers, but by Rolls-Royce and the whole of the British foreign service.

This brings us to the *Convair Liner's* rival, the Vickers *Viscount* with four Rolls-Royce *Dart* propeller turbines, in the British view the best existing aircraft for medium ranges both today and tomorrow.

On the following pages experts from both Convair and Vickers-Armstrongs describe how two firms view the medium-stage aircraft of the future. Neither of the two types would appear to be quite perfect for the present market.

An objective view shows the British design to be more advanced, thanks to its Rolls-Royce turboprops, while the American model can claim a big enough production and sufficient experience to have overcome all teething troubles.

*

However, it is by no means certain that only these two firms, Convair and Vickers, will be in the running in the future. France, Holland, Italy, Sweden, Russia and Spain all have sufficient engineers and experience to be able to make a medium or short-range aircraft. Not only national prestige is involved in such designs, but also trade balances and the export market. By 1958 the whole picture may thus have changed.

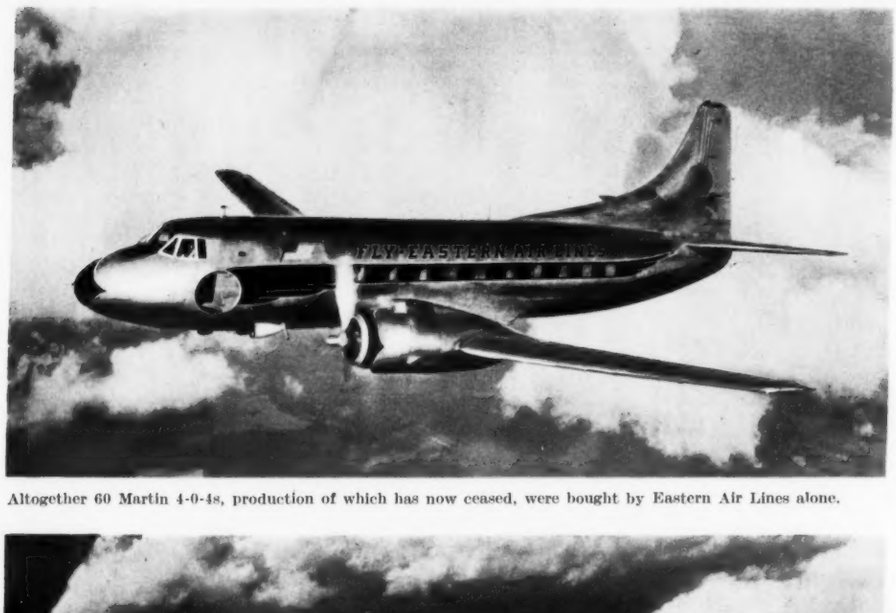
The problem of the medium-stage aircraft has engaged the attention not only of manufacturers but also of their customers, the airlines. For example, six European airlines got together some time ago and founded the Air Research Bureau, in Brussels, one of whose tasks is to work out requirements for the future medium-range airliner. Secretary General of this Bureau is a Swede, Bo Björkman, who gives *Interavia* readers some of his views on the subject in this issue.

The United States has a close network of short and medium-stage services, but in Europe much remains to be done in this direction. Reason for this backwardness is not only the many frontiers and the difficulties they entail, but primarily insufficient schedule frequencies and high fares. Not until frequencies can be increased, and feeder services are provided in heavily populated areas—by rotary-wing or other short-range aircraft—to carry passengers to the centres of medium-stage traffic will it be possible to build up a real air service network in Europe.

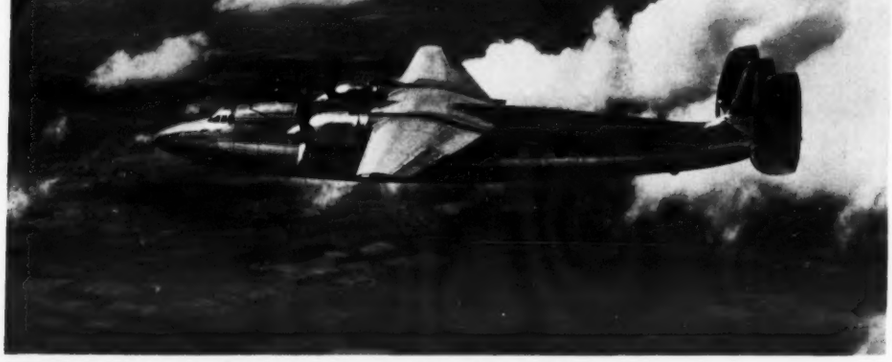
*

Such is the picture at present. Today it is dominated by the rivalry between America's Consolidated Vultee on the one hand and Britain's Vickers and Rolls-Royce on the other. Tomorrow others may have entered the market, and the present scarcity of operationally proved types may soon have disappeared.

Convair Liner 340: the hundredth aircraft of this type was recently delivered; total orders reach over 200 aircraft.



Altogether 60 Martin 4-0-4s, production of which has now ceased, were bought by Eastern Air Lines alone.



Since the war Britain's aircraft industry has developed the Airspeed *Ambassador* . . .

. . . and the turboprop-powered Vickers *Viscount* for medium-stage traffic.

Medium-Range

A Review

Airlines customarily divide their fleets into three categories, short-range and feeder aircraft, medium-stage aircraft, and long-range aircraft. Medium-haul services (roughly 250 to 700 miles) continue to provide a major portion of all passenger volume, namely 40 % of all passenger-miles flown in the United States, roughly 55 % in Europe (including the Mediterranean).

To give some indication of what these figures mean, it should be added that in 1952 American airlines recorded approximately 11,000,000,000 passenger-miles, and Western European roughly 2,800,000,000. These figures are expected at least to double by 1960.

The following survey of aircraft now available for medium-stage services, under development or projected is based on the above considerations.

OPERATIONAL TYPES

USA... the leading position

Even apart from the fact that many airlines are still using DC-3s and DC-4s on their medium-stage routes, most of them acquired from war surplus stocks and converted for civil use, the United States must be acclaimed as the major supplier of medium-range airliners, in the shape of the *Convair Liner 340* and the *Martin 4-0-4*. Both types were developed from slightly smaller predecessors *(Convair Liner 240* and *Martin 2-0-2)*, but incorporate a number of structural and equipment improvements and have increased gross weight, payload (number of seats) and to a certain extent performance. Although Martin stopped production of the 4-0-4 early in 1953, after delivering 101 of them (plus two designated RM-1, for the U.S. Coast Guard), the Convair 340 is still in production. The 100th aircraft of the type was recently put into service: a roughly similar number still remains to be built, and the makers state that by the end of 1954 there will be about 400 Convair 240s and 340s in regular commercial operation.

Britain... also in business

The British aircraft industry has brought out several types suitable for medium stages since the war. Among these, the Vickers *Viscount* with four turboprops has been successful not only in Europe but also overseas (Canada,

Airliners

Australia, Iraq, India). So far orders have been placed for 79 aircraft of the various Series 700 versions—e.g. 701 (B.E.A.), 708 (Air France), 724 (Trans-Canada Air Lines) and others. A large proportion of these are to be delivered before the end of 1954. As described elsewhere in this issue, the *Viscounts* have fully proved their worth in service. In Vickers' opinion, propeller turbine aircraft are the best economical proposition for stages of 200 to 1,000 miles. The recently-announced power increase in the *Dart* turboprops to 1,550 s.h.p. plus 365 lbs. residual thrust will help towards a further improvement in performance and gross weight.

Encouraged by this success, Vickers set about developing the *Viscount* further, and about a year ago announced the *Series 800,* with longer fuselage, higher gross weight (65,000 lbs.) and cabin accommodation for up to 82 passengers in tourist class operations. British European Airways has placed an initial order for twelve.

Alongside the *Viscount* show-piece, B.E.A. has also been operating the twin-engined Airspeed *Ambassador* on its medium-stage routes since the middle of March 1952. Deliveries of this aircraft were slow at first, but B.E.A. has now received the full 18 it had ordered.

A firm place in passenger and freight transport has been won by the twin-engined Bristol 170 *Freighter,* a real "maid of all work", which is used by more than twenty airlines and air forces for passenger, freight and troop transport. An advanced model, the *Freighter Mark 32,* has now been brought out; it is in use by Silver City Airways on their cross-Channel car ferry service.

France... stakes her claim

Since the war three French aircraft manufacturers have come out with new designs for medium-range aircraft. SNCA du Nord has developed a civil version of the Nord 2501 *Noratlas* military transport; Société des Avions Hurel-Dubois has developed the high-aspect-ratio-wing HD. 10 and HD. 31 models into the HD. 32 airliner for mixed passenger and freight

More than twenty airlines and air forces throughout the world use the Bristol 170 *Freighter* for passenger and cargo transport.

Although originally designed as a pure military cargo and troop transport, the Nord 2501 *Noratlas* is also built in a civil version.

Air France has ordered 24 Hurel Dubois HD. 32 passenger and freight aircraft; the French National Geographical Institute and Aigle Azur are each to get four.

The Saab-90 A-2 *Scandia* has proved its worth under widely different climatic conditions, on S.A.S.'s domestic services and the routes of Brazil's Viaçao Aérea São Paulo.

Commercial transports for short and medium runs are also being built by the Spanish firm of Construcciones Aeronáuticas S.A. *Left*, the CASA 201 *Alcotán* for 10 passengers, a series of 100 of which is under construction for domestic services and Air Force. It is at present fitted with Armstrong-Siddeley *Cheetah* engines, though later Spanish E.N.M.A.S.A. *Sirio VIIs* of 490 h. p. each are to be used. *Right*, the CASA 202 *Halcón* for 14 to 18 passengers, with 740 h. p. E.N.M.A.S.A. *BetaB-4* engines. A first series of twenty is nearing completion.

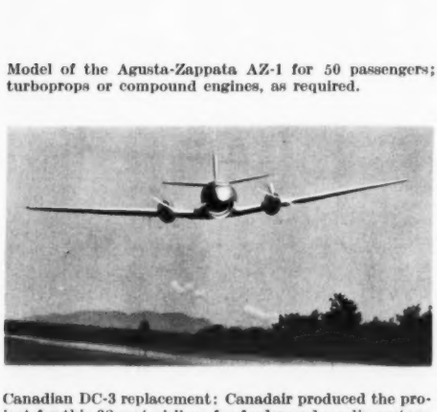
Russia and the Eastern European countries use large numbers of the Ilyushin IL-12 for 27 to 32 passengers.

transport, of which Air France has ordered 24, the Institut National Géographique 4 and Aigle Azur also 4. — Finally, mention should be made of the SNCA du Sud-Ouest's *SO. 30 P Bretagne* which has been built in moderate numbers[1].

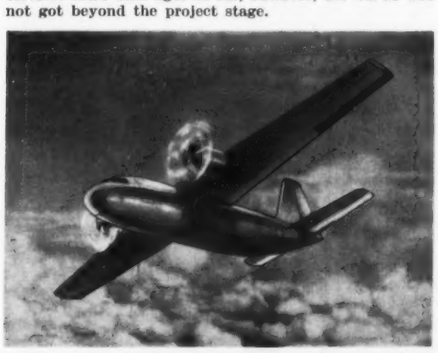
All three types were designed to replace the obsolescent equipment in use in France immediately after the war by fast, comfortable and economic aircraft. In addition, SNCA du Nord set out in the civil *Noratlas* to provide a flexible cabin arrangement to meet the changing needs for passenger, cargo or mixed services on European, African and South American routes. Here Nord stresses that the 2501 can easily be used from small airfields (as can the DC-3), but that in flight and transport performance it resembles rather the DC-4.

[1] cf. *Interavia* No. 12, 1952: "The Advantages of High Aspect Ratios" (Hurel-Dubois); No. 1, 1954: "*Noratlas* in Production", and No. 1, 1951: "Producing the SO.30 P *Bretagne*".

Model of the Agusta-Zappata AZ-1 for 50 passengers; turboprops or compound engines, as required.

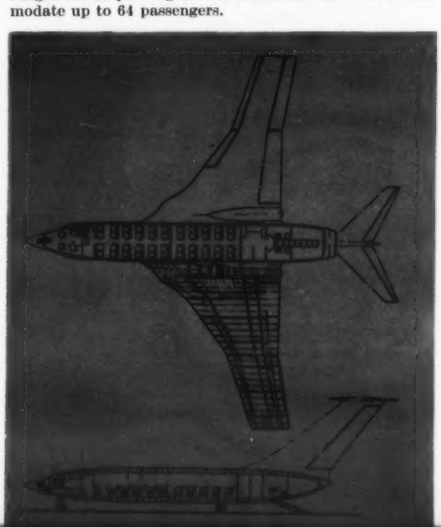


Canadian DC-3 replacement: Canadair produced the project for this 32-seat airliner for feeder and medium-stage services some time ago. So far, however, the CL-21 has not got beyond the project stage.



Percival Aircraft's P. 87 project (Great Britain) is also put forward as a DC-3 replacement.

Fairchild Engine and Airplane's M. 186 project with "cusp wing": seating plan showing first-class cabin arranged for 44 passengers. On tourist runs it could accommodate up to 64 passengers.

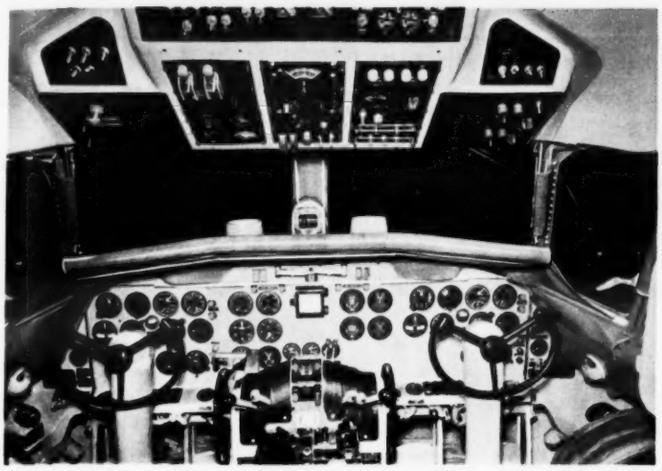


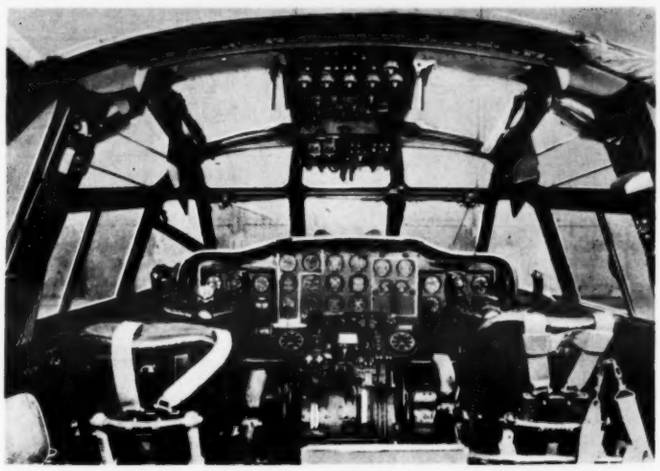
A contribution from the North

Even before the end of the war the highly active Swedish firm of Svenska Aeroplan AB, Linköping, began to think about a modern replacement for the well-tried DC-3. Development began in 1945, and work on a prototype of the Saab-90 *Scandia* started the same year. The first production model flew in 1949. A year later, in July 1950, the Brazilian airline Viaçao Aérea São Paulo introduced a fleet of six *Scandias* on a network joining Rio de Janeiro, São Paulo and Curitiba. Another six months later another fleet of six went into service, this time on Scandinavian Airlines System's domestic network.

Although there was obviously a market for the Saab-90, the makers found that they could not continue to build it at Linköping because of urgent orders for the Swedish Air Force. Negotiations with foreign aircraft manufacturers led in 1952 to an agreement with Fokker, Amsterdam, where the *Scandia* is today being built in small numbers (e.g., VASP has ordered another four and S.A.S. a further two).

The basic idea behind the design of the Saab-90—full designation Saab-90 A-2—was to provide an aircraft for short and medium stages which could operate without first-class airports. With its relatively powerful engines (two Pratt & Whitney R-2180 E-1 *Twin Wasps* of 1,800 h.p. take-off power with water





Pilot's view of an aircraft: cockpit of a *Convair Liner 340* (left), a Nord 2501 *Noratlas* (right) and a Saab-90 *Scandia* (below). A considerable degree of standardization in the arrangement of the instruments can be seen in all types. Engine instruments and gauges are in the centre, flight instruments left and right. Switches for lighting, fuel gauges and flow meters, checking lamps, and in some cases radio equipment, above.

injection), the *Scandia* can also take off from relatively high airfields without reduction in payload. For example, it can take off with its max. gross weight of 35,275 lbs. from altitudes of up to 4,750 ft.

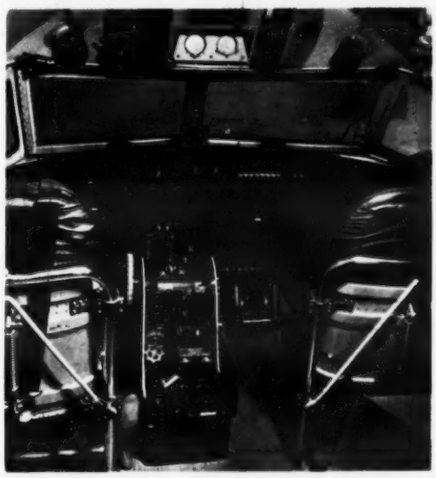
Spain enters the picture

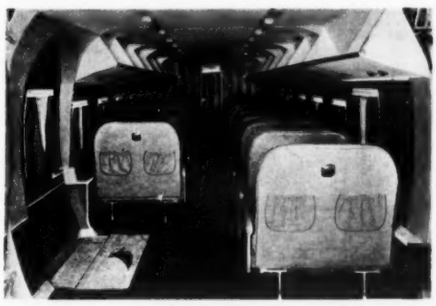
After overcoming considerable initial difficulties, largely due to shortage of foreign currency, the Spanish aircraft industry is making great efforts to catch up with development in other countries. Construcciones Aeronáuticas S. A. (CASA), with plants in Madrid, Getafe, Seville and Cadiz, has a production programme for small and medium passenger and cargo aircraft. The prototype of the twin-engined *CASA 201 Alcotán* started its flight tests as long ago as February 1949. Today the type, accommodating 10 passengers, is in quantity production, and over 100 are to be built for domestic services and the Air Force (training). Encouraged by the success of this model, CASA developed the slightly larger CASA 202 *Halcón*, for 14 to 18 passengers. Like its predecessor, it will also be used for service and civilian tasks. The prototype began flight testing in May 1952, and a first series of twenty is now in production. — Work continued, and two further medium-stage designs have been completed on paper, the CASA 207 and the CASA 208. A prototype of the 207 is to fly at the end of 1954, but the 208 has not yet got beyond the project stage.

PROJECTS AND PROTOTYPES

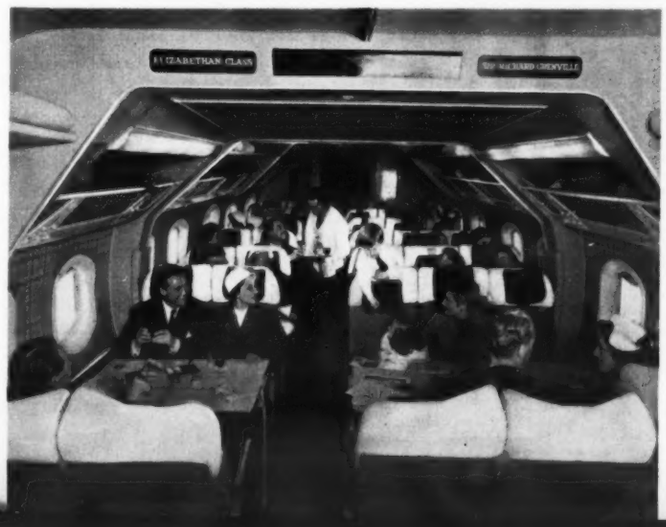
Italian designs

Italy's post-war bid for the civil transport market with medium-stage aircraft of Fiat, Piaggio and SIAI-Marchetti design (Fiat G. 212, SM. 95 and others) was also fraught with difficulties. Development and construction of military trainers continued, however, so that a few firms — Agusta, Piaggio, SIAI-Marchetti — decided to prepare new designs in readiness for a revival of the aircraft business.





The passenger's view: Requirements – and fares – vary . . . Above left, cabin of the passenger and cargo version of the Nord 2501 *Noratlas*, whose seats can be fitted or removed rapidly to meet varying passenger and freight volume. – Above right, inside of a Russian Ilyushin IL-12 . . . with robust reclining chairs. – Below, the roomy cabin of an Airspeed *Ambassador* for first-class services *(left)* and the standard cabin arrangement of the Convair 340 (right).



MEDIUM-STAGE

LAND	AIRCRAFT	POWER PLANT					DIMENSIONS			PASSENGERS	
	Maker and Type	Maker and Type	Take-off power		Cruising power		Span	Length	Wing area	Number	
			h.p.	lbs.	h.p.	lbs.	ft. ins.	ft. ins.	sq. ft.	1 st class	tourist
	GROUP I										
USA	"Convair Liner 340"	2 Pratt & Whitney R-2800 CB. 16	2×2,400	—	2×1,700	—	105′ 4″	79′ 2″	920	44	48/56
USA	Martin 4-0-4	2 Pratt & Whitney R-2800 CB. 16	2×2,400	—	2×1,700	—	93′ 3″	74′ 7″	864	40	up to 44
GB	Vickers-Armstrongs "Viscount 701"	4 Rolls-Royce "Dart 505"	4×1,550	+365	—	—	93′ 8.5″	81′ 2″	963	40/48	53/62
GB	Airspeed "Ambassador"	2 Bristol "Centaurus 661"	2×2,625	—	2×1,650	—	115′ 0″	82′ 0″	1,200	40/47	49
GB	Bristol 170 "Freighter Mk. 32"	2 Bristol "Hercules 734"	2×1,980	—	2×1,220	—	108′ 0″	73′ 6″	1,487	32/40	44
F	Nord 2501 "Noratlas"	2 Bristol "Hercules 758"	2×2,040	—	2×1,665	—	106′ 7.5″	72′ 0.5″	10,893	40	—
F	SNCA du Sud-Ouest SO. 30 P "Bretagne"	2 Pratt & Whitney R-2800 CA. 18	2×2,400	—	2×1,200	—	88′ 2″	62′ 2″	928	30	43
F	Hurel-Dubois HD. 32	2 Pratt & Whitney R-1830-92	2×1,200	—	2×600	—	148′ 7.5″	76′ 4″	1,076.4	34	44
S	Saab-90 A-2 "Scandia"	2 Pratt & Whitney R-2180 E. 1	2×1,800	—	—	—	91′ 10″	69′ 11″	922	24/32	up to 40
SP	CASA 201 "Alcotán"	2 Armstrong-Siddeley "Cheetah 27"	2×475	—	—	—	60′ 4″	45′ 3″	450	10	—
SP	CASA 202 "Halcón"	2 ENMASA B-4	2×740	—	—	—	70′ 9.75″	52′ 6″	617.8	14/18	—
USSR	Ilyushin IL-12	2 Shvetsov ASh-82 FNV	2×1,750	—	2×1,330	—	104′ 0″	69′ 11″	—	27/32	—
	GROUP II										
GB	Vickers-Armstrongs "Viscount 801"	4 Rolls-Royce "Dart RDa. 5"	4×1,540	+400	—	—	93′ 8.5″	94′ 6″	963	56	86
GB	Aviation Traders "Accountant"	2 Rolls-Royce "Dart RDa. 6"	—	—	—	—	77′ 6″	57′ 6″	600	22/36	—
GB	Handley-Page (Reading) HPR. 3	4 Alvis "Leonides Major"	4×870	—	—	—	95′ 0″	70′ 3″	882	36/44	—
F	SNCA du Sud-Est SE. 210 "Caravelle"	2 turbojets (R.-R. or Hispano Avon?)	—	2×10,000 (?)	—	—	112′ 6.4″	103′ 4″	1,577	70	91
F	Hurel-Dubois HD. 45	2 turbojets (R.-R. or Hispano "Avon"?)	—	2×9,000 to 10,000	—	—	147.6′	98.4′	1,184	80/84	—
NED	Fokker F. 27 "Friendship"	2 Rolls-Royce "Dart"	2×1,540	+365	2×1,230	+295	95′ 0″	73′ 0″	754	24/28	up to 36
SP	CASA 207 "Azor"	2 Bristol "Hercules 730"	2×2,040	—	—	—	91′ 2.5″	68′ 5″	924.3	33/40	—
	GROUP III										
USA	Fairchild M. 186	2 turbojets (Wright J-67?)	2×12,000 to 14,000	—	—	—	100′ 0″	98′ 7″	approx. 2,000	44	64
CAN	Canadair CL-21	2 Wright "Cyclone 9 HE"	2×1,525	—	2×785	—	102′ 2.5″	67′ 1″	950	32	—
GB	English Electric	1 Armstrong-Siddeley "Double Mamba"	—	—	—	—	—	—	—	30/32	—
GB	Percival P. 87	2 Napier turboprops	—	—	—	—	—	—	—	36	—
I	Agusta-Zappata AZ-1	2 Bristol "Proteus 705"	2×3,300	+1,190	2×1,950	+530	110′ 3″	91′ 9.5″	1,167.9	50	—
I	Piaggio P. 145	2 Armstrong-Siddeley "Double Mamba"	2×2,540	+770	—	—	98′ 5.25″	85′ 3.5″	882.6	48	—
I	SIAI-Marchetti SM. 132	2 Rolls-Royce "Avon RA. 3-501"	—	2×7,200	—	—	—	—	—	24	—
SP	CASA 208	2 Bristol "Hercules 738"	2×2,040	—	—	—	101′ 8.5″	70′ 1″	1,105.7	40	53

Group I: in quantity production and widespread use. Group II: prototypes; quantity production planned. Group III: projects.

AIRLINERS

CREW	WEIGHTS		PERFORMANCE			Recommended cruising altitude *	TAKE-OFF RUN	REMARKS
Number	Max. gross weight	Max. payload	Max. cruising speed	Max. range miles	with payload of		to clear 50 ft.	
	lbs.	lbs.	m. p. h.		lbs.	ft.	ft.	
3/4	47,000	14,140	284	2,200	5,730	20,000	3,200	More than 200 already supplied or on order. Work in hand to refine and increase performance.
3/4	44,900	11,590	280	2,000 +	5,730	18,000	3,200	Total of 101 of these aircraft built; deliveries completed beginning of 1953. For example, 60 were supplied to Eastern Air Lines.
3/5	58,500[1]	13,320	330+	approx. 2,000	—	20,000+	4,500	Improvements to power plant have increased power to 1,550 h.p. + 365 lbs.—[1] Increase in gross weight to 60,000 lbs. planned.
3/5	52,500[2]	11,650	272	1,200	8,000	15,000	3,425	[2] Gross to be increased shortly to 55,000 lbs.
3	44,000	11,300	193	1,680	8,000	5,000 to 6,500	2,690	Various versions in operation with more than 20 airlines, private undertakings and air forces.
3/5	44,000+	approx. 15,000	210	2,500+	—	9,800	2,690	In addition to the military version, a civil version for passengers, mixed passenger/cargo or pure cargo available.
4/5	43,000 to 44,000	10,000 to 11,000	270	approx. 1,550	—	18,000	3,570	Tests with two Turboméca *Palas* auxiliary turbojets have noticeably improved take-off performance; useful load increased by more than 2,200 lbs.
3	41,900	11,000+[3]	168	1,660	—	9,800	2,590[4]	[3] 11,000+ lbs. payload for a range of 1,120 miles and gross weight of 39,680 lbs.; [4] 2,590 ft. take-off run to clear 40-ft. obstruction.—So far 24 have been ordered by Air France, four by the French National Geographic Institute, and four by Aigle Azur.
3/4	35,275	9,350[5]	242	1,490+	—	9,800	2,700	Used by S.A.S. in Europe and V.A.S.P. in Brazil. Licence production by Fokker, Holland.—[5] A pure freight version of the *Scandia* for 10,000 lbs. max. payload should be mentioned.
2/3	12,125	—	179	620	—	—	—	A series of over 100 aircraft is to be built for use on the Spanish domestic network and for military purposes.
3	17,090	—	205	—	—	9,320	—	Like the CASA 201 for both civil and military use. Production of a first series of 20 is in progress.
5	38,000	approx. 6,600	approx. 220	approx. 1,800	—	8,000 to 9,500	—	In use by the Russian Aeroflot, the Red Air Force, the Czechoslovak airline C.S.A. and the Polish L.O.T. Military version for approx. 8,800 lbs. payload or 35 paratroops.
—	65,000	16,820	approx. 310	1,100[6]	—	20,000	—	[6] With reserves;—prototype to begin flight testing this year.
—	24,000	7,500+	290	1,500+	—	30,000	—	Two prototypes under construction.
—	33,500	10,750	220	1,500 to 2,000	—	9,800	1,575	Two prototypes under construction; passengers and freight.
—	77,000 to 88,000	—	430+	up to 1,550	—	35,000 to 40,000	—	Two prototypes under construction at Toulouse plant; first should be ready for flight by the summer of 1955. Can also be equipped for mixed passenger/freight traffic.
—	88,000 to 100,000	—	430+	1,550 to 1,850	—	approx. 35,000	—	Payload of up to 22,000 lbs. can be carried over 1,550 miles, or more than 17,600 lbs. over 1,800 miles.
3	32,630 to 34,200	9,175 to 9,535	280	approx. 650	—	20,000	4,200	Two prototypes under construction, but with *Darts*, though Wright *Cyclone* 9 piston engines can be fitted if desired.—F. 27 *Freightship* for cargo traffic.
—	33,070	—	215	—	—	approx. 10,000	—	Prototype under construction; first flight scheduled for end of 1954.
3/5	75,000	—	570	—	—	—	—	Projected high-speed airliner; cargo version with 34,170 lbs. payload.
3	32,500	8,580	276	850	4,700+	up to 15,000	—	Canadair projects a further model for 32 passengers in pressure cabin; gross weight 31,970 lbs.; two piston engines.
—	32,000	10,000	—	1,000	—	—	—	Double turboprop engine in fuselage nose.
—	approx. 26,000	—	—	—	—	—	—	Pusher propeller.
—	59,500	11,000[7]	370	1,860+	8,380	23,000	—	Or with 3,250 h.p. Wright compound engines if required.—[7] Normal payload.
5	50,700	14,110	250 to 300	1,550+	—	16,000 to 20,000	3,640 to 4,300	P. 146 for special use with luxury cabin equipment (Government aircraft etc.).
—	approx. 37,500	—	—	870	—	40,000	—	Projected.
—	41,390	—	187	1,430	—	—	—	Projected passenger and cargo aircraft; also troop transport for 42 parachutists or 58 infantrymen; ambulance version for 28 wounded.

* For longer block distances.

Two prototypes of the 36 to 44-seat Handley Page HPR. 3 are under construction. This type too, like the Percival P. 87 and Aviation Traders *Accountant*, falls under the British DC-3 replacement programme (left). – Drawing of the projected Hurel-Dubois HD. 45 high-aspect-ratio jetpowered model (right).

For example, Costruzioni Aeronautiche Giovanni Agusta, of Cascina Costa (Gallarate,) proposes the *Agusta-Zappata AZ-I,* a twin-engined low-wing monoplane for 50 passengers, designed by Engineer Filippo Zappata, and fitted with either propeller turbines (Bristol *Proteus 705*) or Wright compound engines. — Piaggio & Co., of Genoa, have worked out two versions of a twin-engined project, one for normal passenger service, the *Piaggio P. 145,* and the other a luxury version, the *P. 146.* SIAI-Marchetti, of Sesto Calende, who had produced a project a few years ago for a four-jet airliner, the *Chimera II,* now announces another project, for a 24-seat twin-jet model, the *SIAI-Marchetti SM. 132,* which is to be of optimum operating economy over stages of 370 to 720 miles.

American and Canadian proposals

Fairchild Engine & Airplane Co. has now joined the ranks of the firms engaged on the development and production of commercial transports. It has brought out a project for a twin-engined jet model, the *Fairchild M. 186*[2], for 44 to 64 passengers, evidently designed primarily for American domestic use. However, its range lies at the upper limit of what can be termed "medium stages", since the aircraft is to be capable of flying the trans-continental route from New York to Los Angeles with only one intermediate stop and with normal fuel supply.

The *Canadair CL-21*[3], on the other hand, a project for an airliner with two piston engines prepared some years ago by Canadair Ltd., Montreal, is definitely designed for short to medium stages. The same firm also recently announced details of another project, conceived—like the CL-21—as a DC-3 replacement. This is a high-wing monoplane of 32,000 lbs. gross weight, with two piston engines, for 32 passengers or a corresponding amount of freight.

[2] cf. *Interavia*, No. 1, 1954, p. 34.

[3] cf. *Interavia*, No. 9, 1952, p. 490.

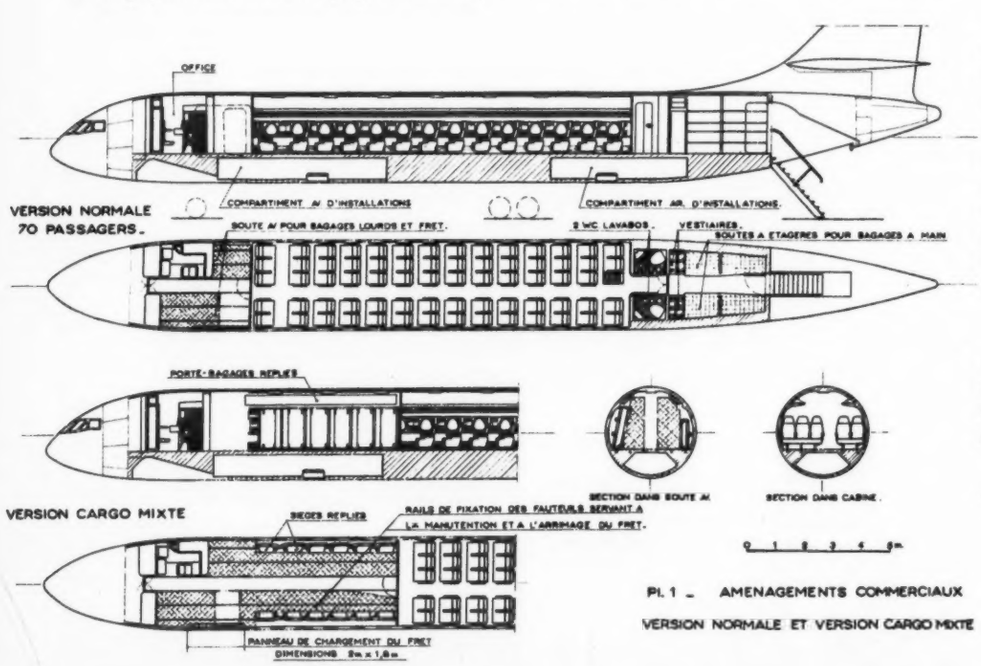
Wanted... a new aircraft

Although practically all the aircraft so far mentioned can be regarded as DC-3 replacements in one respect or another, airlines are still on the look-out for a machine which can take over in full the part of the venerable DC-3[4]. However, this should be a type suitable for short stages, which are today being increasingly regarded as the future domain of the helicopter.

It is thus not altogether surprising that one of the five British firms working on the DC-3 replacement programme, Fairey Aviation Co., should have proposed a gas turbine powered compound helicopter, the *Rotodyne,* the prototype of which is to be ready for testing early in 1956. The other four types are fixed-wing models. *Handley-Page* has two prototypes of the HPR. 3 in construction; *Aviation Traders* are also working on two prototypes of the *Accountant,* with two Rolls-Royce *Darts.* Then *English Electric* has a project for an aircraft with an Armstrong-Siddeley *Double Mamba,* and Percival Aircraft for the *P. 87,* a twin-engined high-wing model with pusher propellers.

*

Seating plan for the SE. 210 *Caravelle*, two prototypes of which are being built at S.N.C.A. du Sud-Est's Toulouse works. – *Top:* normal cabin arrangement for mixed passenger and cargo transport. (In the forward portion reserved for freight, the chairs are folded up against the walls.)


OFFICE
VERSION NORMALE
70 PASSAGERS.
COMPARTIMENT AV D'INSTALLATIONS
COMPARTIMENT AR. D'INSTALLATIONS.
SOUTE AV POUR BAGAGES LOURDS ET FRET.
2 WC LAVABOS.
VESTIAIRES.
SOUTES A ETAGERES POUR BAGAGES A MAIN
PORTE-BAGAGES REPLIES
SECTION DANS SOUTE AV.
SECTION DANS CABINE.
VERSION CARGO MIXTE
SIEGES REPLIES
RAILS DE FIXATION DES FAUTEUILS SERVANT A LA MANUTENTION ET A L'ARRIMAGE DU FRET.
PANNEAU DE CHARGEMENT DU FRET
DIMENSIONS 2m x 1,8m
0 1 2 3 4 5m

Pl. 1 – AMENAGEMENTS COMMERCIAUX
VERSION NORMALE ET VERSION CARGO MIXTE

The development programme for medium-stage aircraft worked out some five years ago by the French Secretariat General for Civil Aviation is also beginning to bear fruit. SNCA du Sud-Est's Toulouse plant is building two prototypes of the twin-jet *SE. 210 Caravelle.* According to Georges Héreil, SNCASE President and Managing Director, the first prototype should be ready for flight testing by June 1955, if the present rate of progress is maintained.

The *Caravelle*, designed with an eye to the requirements of services in the French Union, differs in structure from conventional principles in that its two turbojets are mounted in the sides of the fuselage, behind the passenger

[4] cf. *Interavia*, No. 9, 1952, pp. 486 – 491.

cabin. This provides greater reliability, reduces engine noise in the cabin and simplifies maintenance. It also offers the advantage of a wing structure uncomplicated by the inclusion of engine nacelles. Moreover the engine thrust lines are close to the aircraft's longitudinal axis, so that variations in thrust will have little effect.

The SE. 210's cabin can be equipped for pure passenger services (70 to 91 seats), mixed passenger and cargo or pure cargo operations. In the latter case, the relatively low height of the cabin floor is an advantage for the loading and unloading of bulky goods.

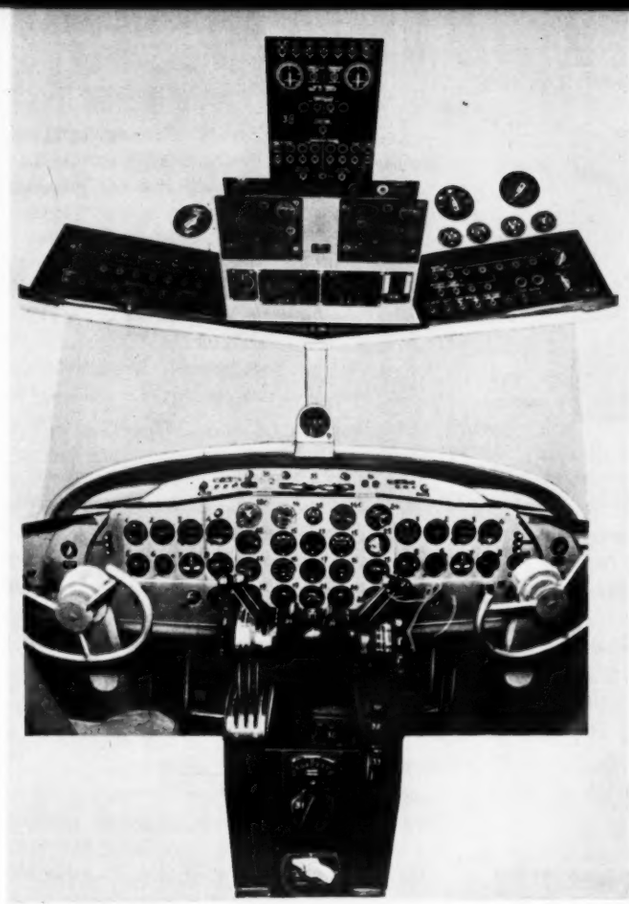
The specification on which the *Caravelle* was based also produced the *Hurel-Dubois HD.45* jet project with typical Hurel-Dubois wing of high aspect ratio.

It would be outside the scope of this article to discuss the structural principles which led Engineer Hurel to use the narrow strut-braced wing for jet aircraft[5]. It suffices here to recall that, according to the French Commercial Aviation Institute, high aspect ratios offer the advantage of increased cruising speed even in turbojet and turboprop aircraft, as well as a shorter take-off run or higher gross weight.

Finally, the Dutch firm of Fokker also consider that non-American medium-stage services are being operated to too great an extent by obsolescent equipment[6]. They too have designed an aircraft—the F. 27 *Friendship*—which, like the Hurel-Dubois HD. 32, the *Scandia* etc., is planned to replace the DC-3 and DC-4. Before beginning their design, Fokkers made a thorough market survey, establishing that an aircraft with pressure cabin and turboprop power, capable of carrying a payload of 5,500 to 6,600 lbs. (24 to 30 passengers and about 660 lbs. of cargo), with a mean cruising speed of 200 to 260 m.p.h. over block distances of 300 to 350 miles, would have good sales prospects. These findings were incorporated in the *Friendship* design. The cabin is normally equipped for 28 passengers, though versions for 24, 32 and 36 passengers can be supplied. With a normal gross weight of 32,620 lbs. and a max. permissible gross weight of 34,200 lbs., the *Friendship* can carry a useful load of about 11,000 lbs. Calculated payload over block distances of 300 miles is 7,900 lbs., or 28 passengers, baggage and roughly 2,000 lbs. of mail and freight. Two prototypes, with Rolls-Royce *Dart* engines, are being built and will be taken over by K.L.M. when official flight tests are completed. Operational tests will then show how far the goals set have been reached or exceeded.

*

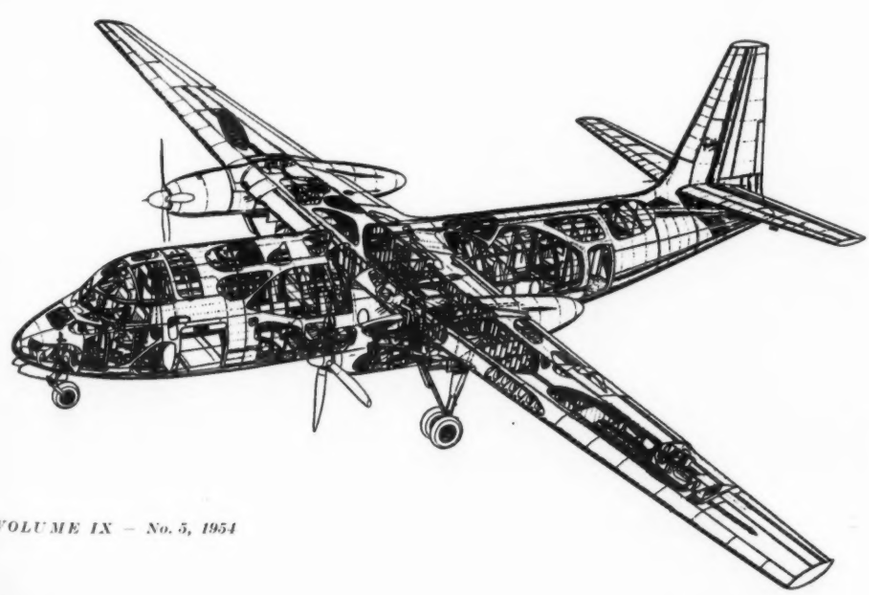
This brief survey shows that nearly a dozen modern aircraft types are available today for medium-stage services and another half a dozen new designs are in an advanced stage of development. Although few of them can find a place on the international market, none of these new designs should prove "superfluous". Taken all together, they prepare the ground for selection of the most suitable medium-range model.



This is how the cockpit of the F. 27 will look: controls and instruments for the engines, the trimming tab controls (29, 30, 31) and landing flap and undercarriage controls (32, 33) are clearly discernible. Flight instruments are arranged right and left of the panel: air speed indicator (1), artificial horizon (2), *Zero Reader* and ILS cross pointer (3, 4), altimeter, compass, turn-and-bank indicator and rate-of-climb indicator (5 to 8). Overhead are engine starters, fuel pump switches, etc. (38) and switches for electrical system, radio compass (41), VOR/VHF and HF radio equipment (43, 44).

A prototype of the Spanish CASA 207 *Azor* is to be ready for testing by the end of 1954.

Two prototypes of the Fokker F. 27 *Friendship* turboprop design are being built and will be tested in operation by K.L.M.



[5] cf. "The Advantages of High Aspect Ratio", by Maurice Hurel; *Interavia*, No. 12, 1952, pp. 695 – 699.

[6] In 1945 – 46 there were chiefly DC-3s and DC-4s in operation. Even in 1952, when post-war developments were available, roughly 40 % of the seat-miles on scheduled services (excluding Eastern bloc and China) were still flown by DC-3s and DC-4s.

Medium-haul transport

The European Market and the Medium Stage Aircraft

BY BO BJÖRKMAN, SECRETARY-GENERAL, AIR RESEARCH BUREAU, BRUSSELS

The Air Research Bureau began to function on October 3rd, 1952, as a result of an agreement signed by Air France, K.L.M.—Royal Dutch Airlines, Sabena and Swissair which recognized the necessity of substituting some semblance of order for the European air transport confusion. Subsequently Scandinavian Airlines System and British European Airways also became members of the organization.

Initially, the Bureau operated on a temporary basis, but the six airlines soon acknowledged the valuable work it was doing. Accordingly, a permanent Bureau was set up in Brussels as from January 1st, 1954.

The aim of the organization is to study the possibility of closer and more efficient cooperation between the member airlines in order to improve and extend their services to the public. To this end the A.R.B. carries out research and prepares reports and statistics—in close contact with the airlines—of general interest to the member companies.

Named to head A.R.B. in 1952 was the noted Belgian economist, Senator de Groote, President of Brussels University, whose first task was to perform a general study of the European air transport system.

Senator de Groote withdrew from A.R.B. at the end of last year and was succeeded on January 1st, 1954 as Secretary-General of the Air Research Bureau by Bo E. Th. Björkman. Björkman was born in Stockholm, Sweden, on May 18th, 1918, and graduated as a civil engineer in 1941. From 1947 to the end of 1953 he worked for Scandinavian Airlines System as Director of Research and Planning.

Is the present aircraft designed for the market?

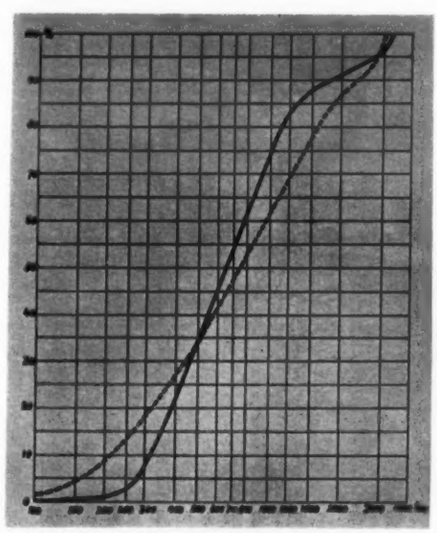
When the DC-3 was designed in the early 'thirties, few people gave any thought to whether it was to be built for short, medium or long distances. The purpose was to get an aircraft with better performance, more payload, more speed and more range than all its predecessors, and the market for the aircraft was the whole world. Some operators have even used it on inter-continental routes, and it conquered a market of a vastness which no other aircraft has reached. The DC-3 is still carrying the main part of the world's air passengers, and as for its output in terms of passenger-kilometres, it still ranks No.1 on the list of all aircraft types existing today.

The start of trans-Atlantic operations on a full scale after the war was made possible by the fact that four-engined long-range aircraft had been produced which could operate over the Atlantic with sufficient payload. In other important markets with big traffic flows there was also an increasing demand for modern equipment with long range to enable intermediate stops to be eliminated and timetables improved. The interest of manufacturers was consequently concentrated on long-range types, and new and more efficient replacements for the DC-4 were presented and delivered.

The new types with greater seating capacity also showed improved operating economy with lower operating cost per produced unit. As soon as traffic volume was great enough to fill the airplanes, they were also introduced on shorter distances. However, from an economic point of view they could never replace the twin-engined aircraft on the shortest stages, as the high ground operating cost of four-engine equipment results in fast increasing average unit costs on such stages. A continuous improvement in efficiency and economy has thus taken place in long-stage traffic where competition with surface transportation is favourable to air transportation. On short distances, on the other hand, competition with surface travel is hard, and yet the market continues to wait for an economic replacement of the DC-3. Most manufacturers and airlines are now concentrating their interest on finding a solution to the short-stage distance problem.

The diagram below shows how total air traffic volume in Europe (unbroken curve) and American domestic operations (broken curve) is distributed over various stage lengths. The two curves are cumulative. The European curve shows passenger-km actually flown, the American curve seat-km available. Short-stage traffic forms a much bigger percentage of the total in the United States.

Abscissa: Block distances (in km)
Ordinates: Passenger or seat km (%)



What is a medium stage distance?

Traffic volume does not show any distinct division into short hauls and long hauls. As shown in the diagram on this page, traffic is spread over all stage distances. Operating experience has also shown that there is an important part of total traffic which encounters neither the long-haul difficulties nor the short-haul problems. This traffic consists mainly of the traffic flows between the great population potentials on the continents.

The demographic commercial and economic situation within a continent influences the volume and the characteristics of traffic, but in spite of the important differences in the basic conditions for air transportation in the United States and Europe, the distribution of traffic over the various stage distances does not show any major difference.

Intra-European traffic includes traffic to points along the coast of the Eastern Mediterranean and thus corresponds to trans-continental traffic in the U.S.A. If this traffic is separated from other European operations, it will be found that the main part of the remaining traffic volume is carried on stage distances between 400 and 1,100 km. In Europe this portion amounts to about 55% of the total. The 400-km limit is interesting in view of the fact that on shorter stage distances the ground operating cost shows a tendency to increase the average unit cost.

Intra-European traffic in 1952, including domestic traffic and traffic between France and North Africa, involved a production of about 4,600 million seat-kilometres. Of the total traffic, 55% is allocated to the medium stage distances, i.e., 2,500 million seat-kilometres. The Convair 340 and the Vickers *Viscount* produce an average of about 35 million seat-kilometres per aircraft per year. Thus, the total intra-European market of 1952 for medium stage aircraft of these types would have corresponded to about 70 airplanes.

It can be estimated that in 1960 the European air traffic volume will be three times that of 1952 and that therefore the medium stage aircraft market will be increased by another 140 airplanes of the above-mentioned capacity. A further doubling of the traffic during the next decade would result in a fleet of 300—400 such aircraft operating on medium stage distances within Europe towards 1970.

What type of equipment is now used for the medium stages?

The tough competition on the main long inter-continental routes has forced airlines to introduce the most modern and efficient equipment; the older four-engined types with high seating capacity which have been replaced on these routes have been transferred to the medium stage routes. As soon as the traffic flow is sufficient to fill these large airplanes without reducing the services below satisfactory frequency, such a policy has in general been economically justified. In several cases, however, this policy has been adopted in the absence of these prerequisite conditions; the airlines have preferred to accept the disadvantages of an unsuitable airplane type in exchange for the advantages of operating a limited number of standardized types in their total fleet.

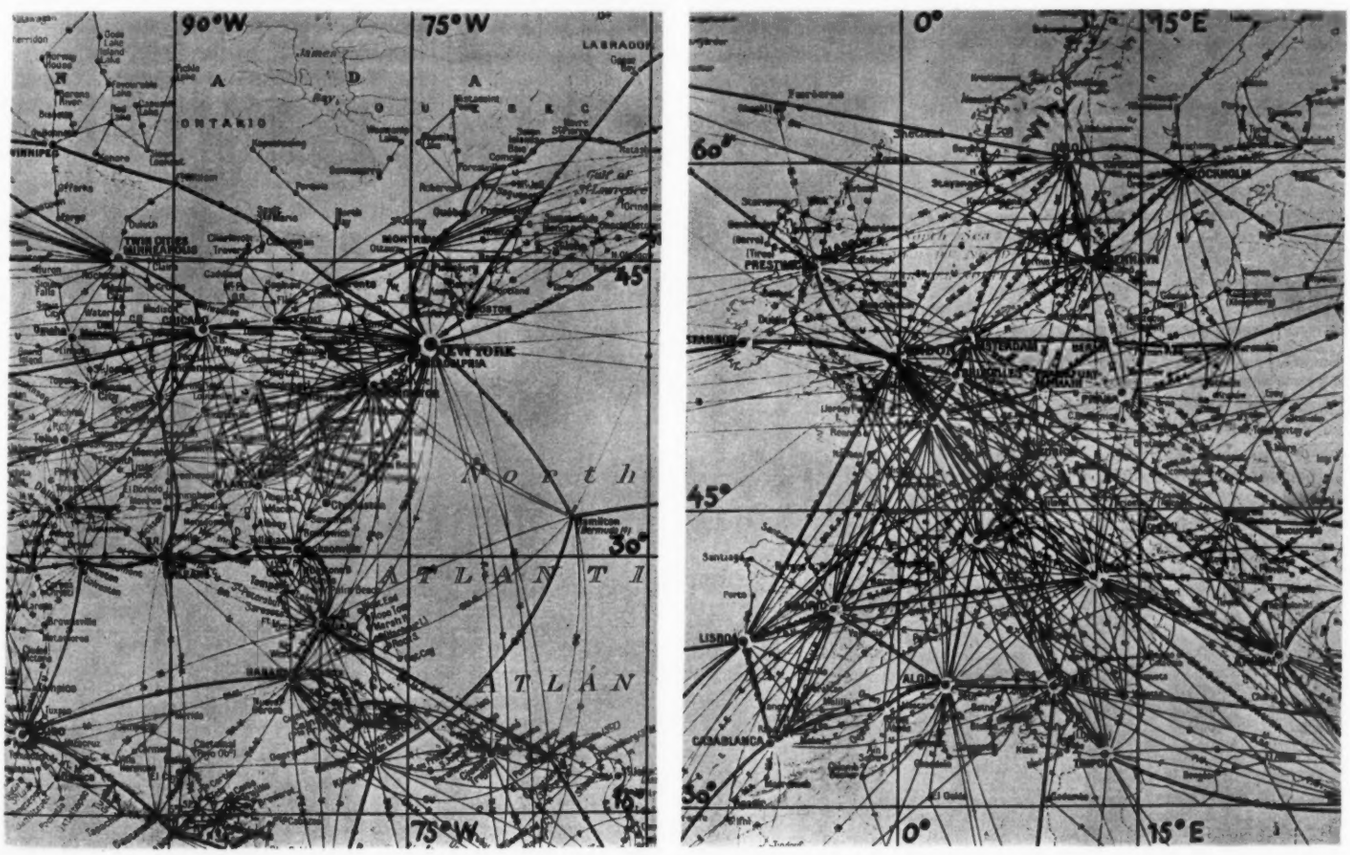
This tendency has been accentuated by the fact that the aircraft types which are primarily designed for medium stage distances, such as Martin, Convair, *Viscount* and *Ambassador,* do not completely cover the requirements of the short-stage routes. The aircraft are mostly too large for routes of a feeder-line character, and from an economic point of view the type with the lowest cost per aircraft km is the one to be preferred. So far no existing model can compete with the DC-3. This aircraft still has no successor and has therefore been used as the short-haul type all over the world. Furthermore, it is operating on medium stage distances where traffic density is low. The DC-3, in fact, increased its output of seat-kilometres between 1948 and 1952.

In 1951 the total production of seat-kilometres in world air transportation was distributed among the various types as follows:

	Number of available seat-km, millions	seat-kilometres in % of total
DC-3	12,400	23
DC-6 and DC-6B	10,500	19
DC-4	10,100	19
Constellation	9,700	18
Convair 240	3,500	6
Stratocruiser	2,900	5
Canadair 4	1,300	2
Viking	1,000	2
Languedoc	300	1
Martin	300	1
Other 4-engine	1,000	2
Other 2-engine	1,100	2
Total 4-engine	35,800	66
Total 2-engine	18,300	34
Grand total	54,100	100

It is interesting to note that the types designed for medium-stage distances offered only about 10% of the total seat-kilometres available, while the production of the DC-3 amounted to 23%. The production of 4-engine equipment was 66% of the total, while inter-continental traffic constituted only 25% of total traffic. It must be pointed out that of the important traffic on the medium-stage distances —about 40% of total world air traffic— only one quarter is operated by types specially designed for this type of traffic.

Sketch maps of short and medium-stage routes on the American East coast and in Western Europe from the new international Larousse Atlas (Merkator's projection, with same scale at Equator – and same distance between meridians – in both cases). A greater percentage of short routes are operated in America than in Europe.



Frequency and size of the aircraft

Air traffic on the American Continent has now reached a level where the frequency of services is sufficient, and an increase will not be a creative factor in the air traffic market. The introduction of four-engine equipment with high seating capacity on the medium stages is therefore quite natural, as this type of aircraft in general operates at the lowest cost per produced unit. The tendency is reflected in the average stage distance of the aircraft, as shown below:

U. S. trunk lines
Average stage distance in kilometres

	1947	*1948*	*1949*	*1950*	*1951*
DC-3	245	221	209	193	185
DC-4	490	406	443	478	332
Constellation	1,100	965	935	900	780

In Europe the same policy has been adopted, but here it has resulted in continued unsatisfactory frequencies of service, and a comparison with the conditions in the United States is very unfavourable to Europe.

The table below shows average seating capacity of aircraft and average frequency:

	Number of available seats per aircraft		Average number of round-trips per week	
	U.S.A.	*Europe*	*U.S.A.*	*Europe*
1947	29.5	21.6	30.9	4.7
1948	31.6	23.2	26.8	4.5
1949	34.5	26.2	27.8	4.3
1950	37.9	27.7	27.1	4.4
1951	40.5	29.5	26.2	4.4
1952	44.0	31.3	29.8	4.6
1952 in % of 1947	149	145	96	98

It is obvious that to a cerain extent high frequency is stimulating to traffic. When calculating total travel time the passenger often has to consider the waiting period between two successive services. One of the most important requirements in air transportation in Europe is therefore to increase frequencies. Fulfilment of this requirement will be hampered if the tendency to introduce larger inter-continental four-engine types with tourist seating capacity for 70—80 passengers persists.

As a result of the wide general growth of air traffic the importance of each separate market will increase, and traffic on medium-stage distances has reached a volume sufficient to warrant the design of special types for this traffic.

What qualities are required of medium-stage aircraft in European operation?

a) Aircraft must show satisfactory operating economy. Operating economy is dependent on revenue possibilities as well as on total operating cost, including direct and indirect expenses. The operating result may be expressed by the relation between the load factor achieved and the break-even load factor. Large types operate in general at low cost per produced unit but the possibilities of achieving high load factors are uncertain.

With the existing air traffic volume in Europe and taking into account estimated future growth, types such as the Convair 340 and *Viscount* may be considered as the maximum suitable types as regards seating capacity. On some long routes with high traffic volume aircraft types such as the DC-6 may be justified, but as a rule aircraft should not exceed a capacity of about 50 seats.

b) Aircraft must offer high travelling speed to the public. The general trend towards higher cruising speeds in new aircraft types is not paralleled by a reduction in ground time. This can to some extent be explained by the increase in the size of aircraft. A large four-engined airplane requires more handling time on the ground, and this extra handling time will often offset the reduced time in the air. Average ground times in minutes per intermediate stop in the United States in 1953 were as follows:

DC-3	Convair	DC-4	DC-6
11	12	22	22

The corresponding figures for Europe are about 30 minutes longer. The airplane must therefore be designed to make possible quick handling, especially with respect to time for loading and unloading of cargo and passengers, flight check and taxiing on the ground. Reduction in ground time by 12 minutes would correspond to an increase in cruising speed from 450 km/h to 550 km/h on a stage distance of 500 km.

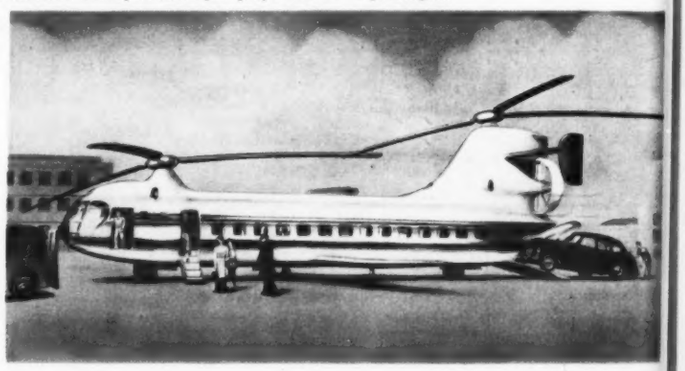
c) Aircraft must be comfortable and must be pressurized. The airframe must be designed primarily for the tourist class version, as tourist travel presumably will predominate in European air transportation. When tourist class fares were introduced in Europe, they were economically justified by the increase in seating capacity, but several of the existing types of aircraft were not suitable for coach versions (DC-3, Convair 240). It will always be easier to derive a first-class version from a coach version than vice-versa.

Are there other means of improving service immediately?

It is always possible to find the ideal aircraft type to be operated in a certain market, but in every case it is up to the air carrier himself to judge between advantages and disadvantages of operating the available aircraft fleet within an existing route system. The desirability of a standardization of the aircraft fleet will always limit the possibilities of adapting aircraft in detail to the demands of each market. Close co-operation between air carriers in Europe will increase the possibilities of this adaptation, and interchangeability of aircraft between air carriers would reduce the disadvantages of operating several different types.

If the authorities create the climate enabling this type of co-operation to come into being, the air carriers in Europe will certainly make use of their new possibilities to improve their service to the public.

The Douglas DC-3 *(left)* designed in the early 'thirties, still performs 23 percent of all seat-kilometres in world air transportation. On short-range services the DC-3 is certain to be succeeded by rotary-wing aircraft in the not too distant future. *Right:* Saunders-Roe twin-rotor *Transport Helicopter* project for 40-50 passengers.



J. G. Zevely is a lawyer by profession and for several years was a member of a prominent New York law firm. In 1948 he joined American Airlines, largest U. S. air carrier and Consolidated Vultee's biggest commercial client, as Assistant Vice-President in charge of State Affairs. A year later he became Manager of Contracts for Consolidated Vultee's San Diego Division, and at the end of 1952 he was promoted Director of Sales and Contracts for the entire Convair concern, in succession to J. V. Naish, who moved up to Executive Vice-President. — Picture shows J. G. Zevely, left, holding the model of a tentatively considered Convair medium-range twin-turboprop transport design featuring an extremely clean power plant installation. At right R. J. Pfeiffer, Convair Domestic Sales Manager, displays a scale model of the piston-engined Convair Liner 340 medium-haul transport in service all over the world.

Convair Executive Views Medium Transport Future

BY J. G. ZEVELY, DIRECTOR OF CONTRACTS AND SALES, CONSOLIDATED VULTEE AIRCRAFT CORPORATION, SAN DIEGO, CALIF.

Many wonder if a point of saturation is being approached, if not already reached, in the medium range transport market. A year ago, estimating the market as we then saw it, that would have been a good question, to be answered only with a generous sprinkling of "if"s. Today, however, I can say with complete honesty that we of Convair believe that the prospects for this transport type were never brighter, and the chances are that our company will be supplying world markets indefinitely.

Up to now medium transport builders have been preoccupied with satisfying the new-plane shortage which existed at the end of World War II, often in successful competition with the builders of larger, four-engine transports.

Actually during the past decade we were only opening the door, without realizing it, to new and expanding opportunities for the medium range airliner; opportunities which should keep our production lines active through another ten years, and stimulate progressive new demands for aircraft in this category.

The door opening period has enabled the airlines to define an outline for the medium range transport hole in their post-war equipment jigsaw puzzle, and to an ever-increasing degree it is becoming apparent that this jigsaw hole will be filled by aircraft shapes stemming from the basic *Convair Liner* design and Britain's *Viscount*. There are no other transports in production which seem to come close to all medium range requirements.

One of the "power packages" of the Convair Liner 340 twin-engined transports. The open "orange-peel" cowling discloses the Pratt & Whitney twin-row radial engine.

Here we have the elements of an economic wedding of airlines and the medium transport manufacturer, and the prospect of their long and happy life together if the alliance proves profitable to each.

We now are engaged in an intensive study of all factors involved, and our preliminary findings, while not conclusive, are encouraging. Our sales engineers have discovered some very interesting facts which indicate extension of the medium range transport market beyond previous expectations.

One of the most significant of these findings is that major airlines are experiencing a notable increase in the frequency of daily trips involving short hauls, and that a large portion of this business is being handled either by obsolescent short-range equipment or by large four-engine transports which are uneconomical in short-haul operation. Using one major U.S. airline as an example, we note that 60 percent of its daily total of flights involve distances of under two hundred miles. This airline, which operates routes calling for trip flights of up to 1,600 miles, dispatches 228 trips per day on flights ranging from 50 to 100 miles in distance, and 300 trips daily for trip distances of 100 to 200 miles. This company's daily schedule also includes 130 trips at ranges of 200 to 250 miles.

There is every indication that the experience of the airline I have cited is typical in representing a growth which may be expected to continue in the short haul business, and that airline operators will be inclined strongly toward the purchase of new medium range aircraft which show an actual profit on short trip distances as well as flights of up to 1,200 miles.

Also, we have discovered in recent studies a strong disinclination on the part of the flying

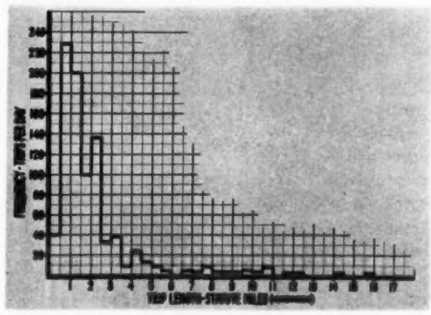
Directly after the war Convair developed a twin-engined transport which came close to a "DC-3 replacement". Designated Convair CV-110, a prototype of the 30-seater aircraft was built and test-flown but subsequently abandoned in favour of the Convair Liner 240.

public to ride in obsolescent equipment after having experienced the comfort of a post-World War II airliner. Evidence of this has been seen in the case of one of the smaller U.S. airlines which had been certificated for DC-3 operation. Its business developed to the point where the operators replaced the DC-3s with Martin 4-0-4 transports. Use of the Martins was short-lived, however, because the Civil Aeronautics Board required a return to DC-3 operation in compliance with the terms of the company's original route certificate. Almost immediately the airline's passenger business dropped to a level well below that reached during its original use of DC-3s, and it is probable that serious losses in passenger revenues will have to be met by a sharp increase of the company's mail subsidy. Should the company eventually be permitted to resume use of modern equipment, it undoubtedly would regain its lost riders and steadily acquire new ones.

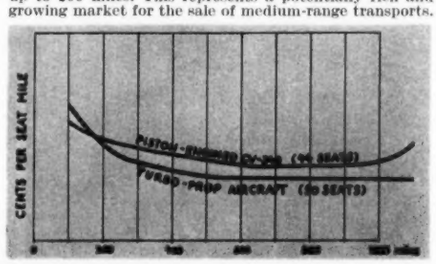
It is inevitable that expanding networks of world routes will add materially to the number of moderately-long flight segments which can be served most economically by the medium range transport. But even more important will be the compounding of short range flights, best maintained by modern transports offering speed and luxury to the ticket buyers and operating economy to the airlines.

Our studies indicate additional marketing areas for the medium transport during the next ten years. There is a real need, although measurably limited, for new planes in the standardization of airline equipment to the end that varying types of obsolescent airplanes will be eliminated and new operating economies will be realized in the maintenance of a fewer number of transports of uniform design. An example is a major U.S. airline which today is operating six Model 749 *Constellations*, one DC-7, twelve DC-6s, twenty Model 340 *Convair Liners*, fourteen DC-3s and three C-47s. This airline profitably could replace its seventeen DC-3s and C-47s with seven additional 340s, and could effect added operating economies by influencing the use of 340s on interchange flights now operated with Martin 4-0-4s and *Constellation* and DC-6 models differing from its own equipment. Another major airline currently is continuing the use of twenty-three DC-3s on short hauls which could be served adequately by only seventeen *Convair Liners*.

Just how far we might go in the production and sale of new medium transports purely as replacements for old equipment, disregarding airplane standardization aspects, is hard to estimate. Admittedly it is a potentially rich market, limited only by the degree to which new-production transports can be shown to do better and more economically the work now handled by hundreds of DC-4s, C-46s, and close to 3,000 DC-3s now in commercial service throughout the world.



Convair made a "Schedule Study" of the operations of one of the "Big Four" U.S. domestic airlines, as of January 25th, 1954. The study, which compares frequency versus trip length, shows 60 percent of the company's daily trips serving short-haul flights in distances up to 200 miles. This represents a potentially rich and growing market for the sale of medium-range transports.



This rough comparison graph indicates Convair's interest in the medium-range turboprop transport. It shows the piston-engine medium transport as most economical for short-haul ranges and the turboprop airplane more economical for trips exceeding distances of 200 miles.

The piston-engined Convair Liner 240 became the most widely sold post-war medium-haul transport (40 seats).

It would be false to say without reservation that our modern medium range transport is "the replacement for the DC-3", although there are many operational conditions suggesting this. Actually, there are some fields of activity in which the DC-3 will continue to be, for an indefinite time to come, an ideal airplane—just as there are certain operational fields in which there is a strong inducement for a revival of the pioneering Ford Tri-motor transports.

In considering airplane replacement opportunities, we are not unaware of the probability that new *Convair Liner* models will offer such improvements in operating economy and

The Convair 240 has now been succeeded by the slightly larger (44 seats plus) Convair Liner 340.

Several years ago the Allison engine company ordered a Convair Liner 240 equipped with two of its own Allison 501 turboprops of 2,750 e. s. h. p. and has carried out extensive testing with the so-called *Turboliner* ever since. Convair is now studying several turboprop projects as the next step in its civil transport programme.

passenger appeal that they will be purchased in considerable quantity to replace many of the 175 Model 240 *Convair Liners* now in airline operation.

Another possible market for continuing sale of new medium range transports exists in the demand for corporation and personal transports. Obviously this is a relatively small market, yet one that commands the close attention of our sales people. Some of the more optimistic in Convair think that this market might absorb fifty transports during the next few years. Our conservatives are inclined to cut this estimate in half.

Not to be overlooked, of course, is the military market for new medium transport designs. On the basis of past history, it is one which holds promise of doubling the number of sales we may effect in the commercial field. Orders for military counterparts of a commercial model have just about kept pace with the numbers of commercial planes our company has produced. This has been true in our manufacture of the basic Model 240 design, and also the Model 340. It seems to be a fairly reliable rule-of-thumb that total sales for a good transport will be divided between military and commercial orders, and that commercial orders for an American aircraft will be divided equally in domestic and foreign sales.

We also are considering a fairly new sales outlet in the export of military models to foreign governments; a limited market, but well worth exploring. Already we are allowed to export the Model 240 military utility transport to foreign governments, and this privilege may be expected to extend to the Model 340 after our own Government's needs are satisfied.

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Such are the "expanding opportunities," as we see them today, in the medium range transport manufacturing industry. We now are engaged in estimating the number of planes which may be required for these markets, and are hard at work on prospective new model designs.

From all present indications, the future medium transport market will call for an improved piston engine model for very short range traffic, and a turbine-propeller transport for flight ranges between 250 and 1,200 miles. Both designs, I believe, will adhere closely to today's basic *Convair Liner* configuration.

We think that an advanced model of the present Model 340 *Convair Liner* will be the ideal design for route segments up to 250 miles in length, a point at which the turbine-propeller transport will begin to show greater operating economy. With this in mind, we now have in progress a Model 340 speed improvement study which shows promise of increasing cruise speed, lowering stalling speed, and permitting a material increase in gross weight. We are planning to offer operators of existing 340s a conversion kit which will bring their present equipment up to performances we anticipate for the contemplated new model.

Fortunately, we seem to have made a good decision in having designed the Model 340 with structural strength to accept future installation of turbo-prop power.

In the light of air route developments of the past several years we have considered a variety of designs for a turbine-propeller transport. Invariably our own studies, as well as those made by persons outside our company, have produced specifications for a medium-range turbine-propeller transport that coincides almost exactly with an enlargement of the Model 340.

We do not yet have a firm turbo-liner design, but I can say that we are considering seriously a configuration which calls for lengthening of the present cabin by fuselage inserts, to provide for roomy seating of 48 or 50 passengers and extensive improvement of cabin conveniences for the passengers.

Model mockups for such a design show a close similarity to the Model 340 shape, with the exception of a notable departure in the nacelle structure. The turbine-propeller nacelle will be a long and slender structure having practically no intrusion upon the upper surface of the wing, in contrast to the relatively bulky piston engine nacelle which sweeps over the upper wing surface of today's 340s. The proposed turbine-propeller nacelle offers an exposure of additional wing lifting surface, a marked reduction in frontal area drag, discharge of engine exhaust beneath the wing, and mounting of the propeller ahead of the cabin seating area.

Although two Model 340s experimentally equipped with turbine-propeller power will shortly be in flight for extensive testing and although tentative engineering plans already are being drawn, it is quite likely that we will not be prepared to have a commercial turboliner ready for sale much before 1957. For one thing, we are inclined to approach our final design cautiously, to be certain that the end result in passenger accommodations, performance and operating cost coincides with future requirement estimates of our customers, the airlines. Too, we do not feel it likely that we can expect to have at any appreciably earlier date a turbine-propeller power cell which will meet our own firm requirements for a unit which will deliver 4,000 shaft horsepower and have a 500-hours overhaul period.

Vickers-Armstrongs' Point of View

BY CHARLES GARDNER,
ASSISTANT TO THE MANAGING DIRECTOR, VICKERS ARMSTRONGS AIRCRAFT DIVISION

Wing Commander Charles Gardner, O.B.E., A.R.Ae.S., is probably best known as the Air Correspondent of the British Broadcasting Corporation, before and after the war. Born in 1912, he served as a B.B.C. war correspondent with the R.A.F. in France from 1939 to 1940 and as a pilot with the R.A.F. on North Atlantic routes, the Middle and Far East from 1940 to 1945. He joined Vickers-Armstrongs as Assistant to George Edwards, Managing Director of the Aircraft Division, early this year.

The forward design philosophy for medium-stage transport aircraft of the Vickers-Armstrongs Aircraft Division, is, of course, in many ways linked with the *Viscount*.

Up to the end of last summer, the propeller-turbine airliner was something passionately believed in at headquarters in Weybridge, but it was unproven in airline service. British European Airways had started their first *Viscount* services in April, and the showing made with them was being watched by airline operators all over the world. Interim figures of economics and passenger attraction issued by B.E.A. in mid-summer were encouraging, but the analysis of the first six months of scheduled *Viscount* services proved to be quite remarkable.

During those six months, which naturally included "teething troubles" and all the other adverse factors attached to the introduction of a new type of transport, B.E.A. made an average all-in profit over total *Viscount* cost of £64 per flying hour. The average break-even load to cover all expenditure (including overheads and interest on capital) was 51%. The direct operating cost break-even load factor was 28.1% and the "passenger-attraction" of the aircraft was such that the average swing-over to B.E.A. from competing airlines was over 16%. On several routes this swing-over was as much as 25% and at the end of the first six months was still on the up-curve.

This result, incidentally, was achieved on *Viscounts* of a lower all up weight and a less economic performance than the models now offered which have the advantage of the uprated *Dart* engines. Furthermore, the engine overhaul period was 500 hours as against the 600 now allowed, and this period is shortly to be lengthened to 700 hours.

I think we can say, therefore, that the present Viscount 700 Series has proved the case for the propeller-turbine airliner on routes from 200 to 1,000 miles, and some operators are proposing to use the plane for short sections of only 100 miles.

Looking immediately ahead, the progressive improvements in *Dart* engine power will clearly allow the *Viscount* to be developed. This will allow high density lay-outs for up to 70 passengers and also make possible a version with a still air range of 2,200 miles. The elasticity of such an aeroplane will make easier the task of "tailor-making" the various editions of the aircraft to suit the specific (and differing) route requirements of operators in various parts of the world.

Our experience with the "Viscount" confirms our belief that the large majority of medium routes are best catered for by a propeller-turbine machine with a gross weight of between 60,000 and 70,000 lbs. In this way the many operational and other advantages of the gas turbine are made available in a combination of speed, over-weather comfort, and economy which cannot be rivalled by piston-engined transports.

The longer types of internal "medium" route, such as those now served by DC-4's, DC-6's and, to an extent, *Constellations,* also fall, in our view, within the turbo-propeller field. For these services a four-engined propeller turbine aircraft cruising above 400 m.p.h. and carrying 70 first-class or 85 "standard" passengers is, we think, the right answer. The difference in "block-time" between such an aeroplane and a pure jet transport of comparable size would only be in the nature of half an hour over 1,500 miles, whereas the propeller-turbine aircraft would clearly be more flexible and less critical as to routes and airfields. The attraction of a pure jet on this kind of operation could only be at the long end of the range-scale, and would be secured at the expense of route interchangeability.

Long range overseas operation such as London—New York and London—Montreal is, however, the province of the pure jet, providing its operating economy is at least comparable to a propeller-turbine. On these routes the high speed of a jet aircraft makes an appreciable difference to journey time, and although a very fast propeller-turbine aircraft could possibly be developed which would cut into this speed advantage, it would be likely to run into difficulties on the score of propeller noise and vibration.

Cockpit of a Series 700 *Viscount* of B.E.A. At top, just left of centre, the Decca Flight Log (without chart).

The Vickers-Armstrongs *Viscount* Series 700 four-engined turboprop medium-stage airliner, of which 79 have been ordered by ten airlines; also on order are 12 of the larger Series 800 *Viscounts* for B. E. A.

Since the main thing which air transport sells is speed, it is obvious that in all cases where the stage length is sufficiently long for the pure jet to show a distinct saving in time, then the deciding factor becomes one of economy. We believe that the by-pass engine, such as the Rolls-Royce *Conway,* will offer a long-haul economy comparable to the conventional 350/400 m.p.h. propeller-turbine aeroplane, and if this is the case, then that should settle the matter.

To sum up: It is our belief that the shorter ranges (200—1,200 miles) will be covered by four-engined propeller-turbine aircraft of about 65,000 lbs., cruising about 330 m.p.h. The longer-range (1,000—1,800 miles) type of operation (and to an extent, the high density short-range routes) will need a four-propeller turbine aircraft cruising at over 400 m.p.h. and carrying up to 85 passengers.

The 2,500 miles stage and upwards is most likely to be covered by a big pure jet large enough to take care of adverse winds and flexible enough to cover a fairly wide height band. The economy of the by-pass engine should make such an aeroplane show up well on cost against even the slower kind of big propeller-turbine machine.

In all such analyses as the one above, it is clear that there can be no hard dividing line between the useful fields of the pure jet and the propeller-turbine aircraft. There is bound to be an "overlap" route distance where a good case can be made out for either. This "overlap" stage-length is from 1,500 to 2,000 miles, but the more flexible route adaptability of the turbo-prop is, in our opinion, a deciding factor here. The propeller-turbine can come well down below this distance and still retain its economic attractions; the pure jet cannot, save on a very few "ideal" high density routes.

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Turning from general matters to more precise configurations of wing shape and wing position, we firmly believe that the moderately swept wing with buried engines is correct for the pure jet, whereas the conventional straight wing is what is needed for the turbo-prop machines.

The rival attractions of high or low wing settings have been fairly well aired for many years, and the matter is not fundamentally altered by modern increases in speed. For the aircraft constructor the weight penalty of high wings and the correspondingly long-travel undercarriage looms fairly large, whereas some operators feel that the enhanced outside-view is a sufficiently important passenger attraction to offset this. The answer to this problem, as with so many others, comes within the law of supply and demand.

The large windows are a characteristic feature of the Series 700 *Viscount.*

Another question to which some modern importance is attached is that of freight and "mixed load" aircraft.

Our view is that the civil freight aircraft pure and simple is clearly a specialised machine requiring large loading doors, ramps, and specially strengthened floors. There is, as a rule, no particular need for it to be fast, but acrobatic performances out of small airfields are preferred. The "mixed-load" aircraft, however, must primarily be a passenger-plane and be complete with all the passenger amenities of speed, pressurisation and comfort. A number of operators have a requirement for aircraft which can vary their load-proportions from day to day as between people and freight, and it is relatively simple to "tailor-make" a convertible model of a standard airliner to meet such markets. This includes the provision of large doors where needs be.

Our actual experience on customer requests of the above and of similar nature has convinced us that, although the "standard production plane" may be a pleasant engineering dream, it is seldom likely to be achieved.

No two operators ever have the same requirements, and always there is a critical route stage or a specialist load consideration which calls for "tailor-made" modifications—often quite extensive. It is our belief that, within the design limitations of the aircraft, these requirements should be met. When a customer is paying anything from quarter of a million pounds to nearly a million for his aeroplane, he is entitled to get a plane that "fits" him exactly. For this all-important reason the buying of aircraft "off the peg" is never likely to be an extensive practice, and delivery times are equally not likely to be reduced much below those reigning today.

Vickers Armstrongs Aircraft Division, therefore, remains entirely "sold" on the propeller-turbine as the fastest and most profitable configuration within sight for short and medium stages, although two sizes of aircraft may be needed to cover the varying load/range requirements. The pure jet does not take over until the 1,500—1,800 mile routes—after which the by-pass engine seems to be the best choice.

A New Lufthansa? Not Yet Awhile!

BY KURT W. STREIT, MUNICH

The following article has in some respects been superseded by the events of March and April, which should allay the author's scepticism to some extent. Since the beginning of the year the German Federal Transport Minister has made strenuous efforts to get German commercial aviation started; he has received prominent foreign experts in Bonn; he has paid visits to England and Switzerland and been remarkably active in creating the basic conditions for an early inauguration of German air services.

In both personnel and equipment questions he appears to be striking out along new lines, which do not altogether tally with the plans of the competent Bonn agency or of the Board of Luftag (preparatory company for the new Lufthansa). Speaking at Frankfurt on March 27th, U.S. High Commissioner Conant stated plainly that the time had come when German sovereignty should be restored even without the immediate conclusion of a peace treaty. If this should happen, there would theoretically and legally be little to prevent German air services from being opened this summer.

The practical side of the problem is described in the following article. The writer, Kurt W. Streit, is one of the most qualified of Germany's aviation writers.

Editors

"Here in Germany we have been chasing, our tongues hanging out, after rearmament and after the changes in the Constitution needed to make it possible. However, the same people who have been encouraging us from outside now inform us in official notes that the final step towards this goal cannot be recognized as valid and must therefore be forbidden. A grotesque situation . . ."

So wrote one of the best-known West German commentators, in the leading Munich newspaper "Süddeutsche Zeitung" on March 22nd, of the diverting cat-and-mouse game being played over West German rearmament.

It was the sales executive of a European airline firmly estabilished in the German market who drew my attention to the quotation. With a charming smile he added: "We have nothing to fear from talented people who have the misfortune of putting the cart before the horse. German air services? Not yet awhile!"

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The German Government agencies responsible for aviation must be complimented on having done a thorough job of work when they permitted the whole question of a new German airline to be tied to the Bonn Treaty. This treaty cannot come into force until the agreements on the European Defence Community have been ratified by the member States.

It is an established fact that the Occupation Statute, still in force, prohibits any commercial flying by German nationals. So far the only steps announced to remedy this situation—in case ratification of the E.D.C. agreements is still further delayed—are German efforts to get the air transport articles removed from the Bonn Treaty, by bilateral understandings with the United States, the United Kingdom and France, so that they can enter into force earlier. These efforts have good prospects of success; however, they are two years late. An exchange of personal notes, dated May 26th, 1952, between Federal Chancellor Adenauer and the three Western Foreign Ministers expressly left the door open for certain provisions of the treaty to be put into force before the treaty as a whole.

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The question that forces itself to the mind of every qualified observer thus is:—Did or does the Federal German Republic perhaps not want an airline of its own?

It is true that a few years ago there were circles who, influenced by an inspired propaganda on the "basic unprofitability of air transport", pleaded against the creation of a German airline. They recommended retaining the present situation in which nearly thirty foreign airlines provide services to and through Germany, despite the concomitant loss in foreign currency (roughly $25,000,000 a year). This, however, was not at all what the advocates of a new German airline had in mind. While realizing clearly that initially such an airline must inevitably operate at a loss, they quoted the encouraging example of the old Lufthansa. No, there can be no doubt about it, a German airline was wanted. But not one run by private enterprise!

All this created purely domestic German tension which has left its mark on the whole course of the preparations officially in progress ever since 1951.

When in October 1952 Hans M. Bongers, head of the Federal Transport Ministry's "Air Transport Preparatory Committee", submitted to his Minister the Committee's final report on the recommended scope of future German air transport activities, he could have had no inkling of what would remain of this project less than two years later, in the early summer of 1954, on the eve of its possible realization. Perhaps the fear again arose that some "unau-

thorized person" might get control of the new German airline, when the Aktiengesellschaft für Luftverkehrsbedarf (Luftag) was founded in great haste on January 6th, 1953—the 27th birthday of the old Deutsche Lufthansa—after violent internal struggles. But even at this time the Committee's plan was the nucleus of all hopes: opening of services with twenty to twenty-four aircraft, half of them for medium stages and the other half for long stages.

How far could such a programme be materialized with the capital of six million marks then available? An early increase in capital was imperative, especially as a decision on the type of equipment to be bought was becoming urgent if the long delivery delays were to be adapted to the programme.

But funds were not forthcoming . . . The Federal Finance Minister could not agree to add an undertaking which, according to his Transport Minister colleague, would inevitably require high subsidies, to the burden of the Federal Railways. His resources were even more scanty than had been expected. Talks by Luftag Chairman Dr. Kurt Weigelt and Board Member Hans M. Bongers with the rising West German industry awoke no response. Men such as Dr. Plesman of K.L.M. and Juan T. Trippe of P.A.A. came and went. Contrary to the wishes of the Transport Minister, a plan was worked out for a foreign loan, but not put into effect. A suggestion that German hotels be exchanged for aircraft from P.A.A. came to nothing.

Finally there was nothing else to do but to fall back on the Finance Minister and cut the original equipment plan of twenty to twenty-four aircraft to eight, four Convair 340s and four Lockheed 1049s. This disregarded the fact that the profitability of an air transport undertaking grows only with the traffic volume offered, and that statistically the German requirement for air services in 1953 was measured as nearly 9 journeys per 1,000 population and that—leaving aside all considerations of freight—the proportion of German passengers on European services to and from West Germany was 80% and on services to the United States 12%.

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In these circumstances four plus four aircraft are not eight, but at best a drop in the bucket . . . An airline with a fleet of no more than eight units has no place today even in Europe. The Luftag knows this as well as anybody else, but lack of funds has tied its hands.

What then are the plans for scheduled services with four *Convair Liners* and four *Super Constellations?*

In a renewed effort to persuade private enterprise to take a share in the airline, Luftag recently sent round a circular to the West German industry. This gave the above reduced figures for traffic volume and can therefore be taken as an indication of present plans. It will be seen that it is hoped to reach 42% of the original traffic volume planned with only 33% of the equipment.

	1954	1955			1956			1957		
	Europe only	Europe	North Atlantic	Total	Europe	North Atlantic	Total	Europe	North Atlantic	Total
Route network in km	3,630	3,630	6,636	10,266	3,630	6,636	10,266	3,630	6,636	10,266
Flying hours	5,254	6,165	7,533	13,698	6,165	8,630	14,795	6,165	8,630	14,795
Tonne-km offered in 1,000 ..	6,109	8,145	27,589	35,734	8,145	34,485	42,630	8,145	34,485	42,630
Tonne-km sold in 1,000	1,725	3,169	13,777	16,946	3,917	19,345	23,262	4,333	21,053	25,386
Load factor in %										
a) Passengers, freight										
On-season (5 months) ...	35	45	45	—	60	55	—	65	60	—
Off-season (7 months) ..	25	35	45	—	40	55	—	45	60	—
b) Mail, whole year	100	100	100	—	100	100	—	100	100	—

Initially it is planned to run European services to France, England, Italy and Switzerland, and to enter the North Atlantic arena in mid-1955.

The circular to private enterprise is very conservatively worded: ". . . The aircraft needed for the proposed inauguration of services inside Europe in mid-1954 and to North America a year later have been firmly ordered. Payment terms have been worked out to meet the particular financial condition in which the German airline will find itself in its early days.

"The modest set-up initially projected needs an investment of roughly 84 million Marks, distributed as shown in the following table:

I. TRANSPORT OPERATIONS	Thousand Marks	II. SPECIAL PURPOSES	Thousand Marks
1. Aircraft		**1. Training**	
4 Convair CV-340s	12,754	Aircraft	517
4 Super Constellations	34,384	Spare engines	52
	47,138	Spares	210
2. Reserves		Other equipment	274
Spare Convair engines	1,306		1,053
Other Convair spares	4,218	**2. Subsidiaries**	130
Spare Super Const. engines	4,573	Total II	1,183
Other Super Const. spares	9,767	Total I	79,136
	19,864	Total I and II	80,319
Total 1 and 2	67,002	+ 5% reserve for unforeseen developments	4,015
3. Technical and commercial		Grand total.	84,334
Main administration	473		
Stations and agencies	2,406		
Technical basis	4,755		
	7,634		
4. Liquid funds	4,500		
Total I	79,136		

Provision of this capital can be spread over until 1960, as the following table shows. The sums put down for 1956 to 1960 are needed to pay off the remaining instalments on the aircraft.

CAPITAL INVESTMENT

	In thousand Marks		
	Foreign currency	German currency	Total
1953	13,028	5,753	18,781
1954	23,840	5,825	29,665
1955	10,420	2,380	12,800
	47,288	13,958	61,246
1956	6,483	259	6,742
1957	7,256	289	7,545
1958	5,791	231	6,022
1959	2,618	105	2,723
1960	54	2	56
	22,202	886	23,088
	69,490	14,844	84,334

"Capital required by 1955 is about 61,000,000 Marks and is shortly to be covered by an increase in capital and a credit for the possible remainder . . . The proposed capital could already (at the time of the circular) be raised to over 40,000,000 Marks, if the Länder governments and private enterprise will participate in the increase.

"Both sides have proved and announced (?—Author) their practical will to cooperate and to build up German air services in both the past and the present. It would be directly in the interests of the general economy, which the new German airline will primarily serve, for them (Länder and private enterprise) to contribute towards the capital of the new undertaking, as they did in 1926 in the foundation of the Deutsche Lufthansa and before that the Deutsche Aero-Lloyd."

It is further added that arrangements have been made with the competent agencies for the supply of foreign currency up to 1960, and a Federal guarantee obtained to cover claims by creditors, especially foreign, until 1960. Federal agencies consider, it is stated, that losses should be covered from the public purse, so that private shareholders will be free of such obligations. On the other hand, the Government did not feel prepared to grant private shareholders other direct or indirect concessions during the initial years of loss. There could therefore be no guarantee of dividends or tax reductions to begin with.

Calculated financial returns are given in the following table: for 1954 a loss of 20,500,000 Marks, for 1955 of 26,800,000 Marks, for 1956 of 17,709,000 Marks and for 1957 of 14,100,000 Marks.

ESTIMATED PROFITABILITY FOR THE 1954 TO 1957 BUDGET YEARS

	IN THOUSAND MARKS											
	1954 [1]			1955 [2]			1956 [3]			1957 [3]		
	Europe	North Atlantic	Total	Europe	North Atlantic	Total	Europe	North Atlantic	Total	Europe	North Atlantic	Total
I. Operating revenue	3,366	—	3,366	6,041	21,602	27,643	7,031	32,094	39,125	7,777	34,704	42,481
less 5 % for unforeseen difficulties	168	—	168	302	1,080	1,382	352	1,604	1,956	389	1,735	2,124
	3,198	—	3,198	5,739	20,522	26,261	6,679	30,490	37,169	7,388	32,969	40,357
II. Expenditure												
1. Actual costs	17,706	2,984	20,690	13,932	29,227	43,159	13,288	31,523	44,811	13,179	31,164	44,343
2. Depreciation	1,889	—	1,889	2,039	5,417	7,456	2,039	5,495	7,534	2,039	5,495	7,534
	19,595	2,984	22,579	15,971	34,644	50,615	15,327	37,018	52,345	15,218	36,659	51,877
5 % for contingencies	980	149	1,129	798	1,732	2,530	766	1,851	2,617	761	1,833	2,594
	20,575	3,133	23,708	16,769	36,376	53,145	16,093	38,869	54,962	15,979	38,492	54,471
III. Deficit	17,377	3,133	20,510	11,030	15,854	26,884	9,414	8,379	17,793	8,591	5,523	14,114

[1] Inauguration of European services and preparation of North Atlantic services
[2] Full year European services and inauguration of North Atlantic services
[3] Full year European and North Atlantic services

A difficult beginning . . .

The last paragraph but one of the circular stresses that the Federal Government, which has shouldered the heavy initial costs of the airline, is desirous that the company should be under mixed private and Government financial control.

*

Comment superfluous!

The thirty airlines now operating air services to Germany are in luck. They are opposed by an infant domestic German air transport organization which, because of the fetters placed on it from the beginning, has so far been unable to show any private initiative. It is thus in no way in a position to equal the proverbial West German economic marvel. The cart has clearly been put before the horse in West German air transport, and planning round the conference table was probably too timid at the outset.

New Lufthansa?—Not yet awhile!

As the above went to press, Dr. Hans-Christoph Seebohm, West German Transport Minister, wrote in the Federale Government's official «Bulletin» that the initial capital of the future Lufthansa would be 50,000,000 Marks. Editors

Vertical Risers

The Lockheed and Convair vertically rising fighters, briefly mentioned in last month's issue of *Interavia Review*, today appear as the "glamour girls" of the 1954 U.S. aviation scene. Photos of the Lockheed XFV-1 and the Convair XFY-1 have been on Page One of every major newspaper in the country, and they have become a "must" for the nation's popular magazines.

The fact that the U.S. Navy sponsored the "vertical-riser" projects suggests that the two aircraft were designed for operation from the limited space of aircraft carrier decks, cargoes, troop transports and even destroyers to protect the ships against air attack. They could be similarly employed by the Air Force for the defence of important industrial plants which would thus have their own fighter protection without the construction of additional costly and space-consuming airfields. Finally, they would be suitable for the defence of cities without chains of fighter bases, of vital harbours, rail yards, etc.

At first glance, the two aircraft look vaguely alike, except that the Lockheed type has a straight wing while the Convair model features a delta wing like several of the company's recent combat aircraft.

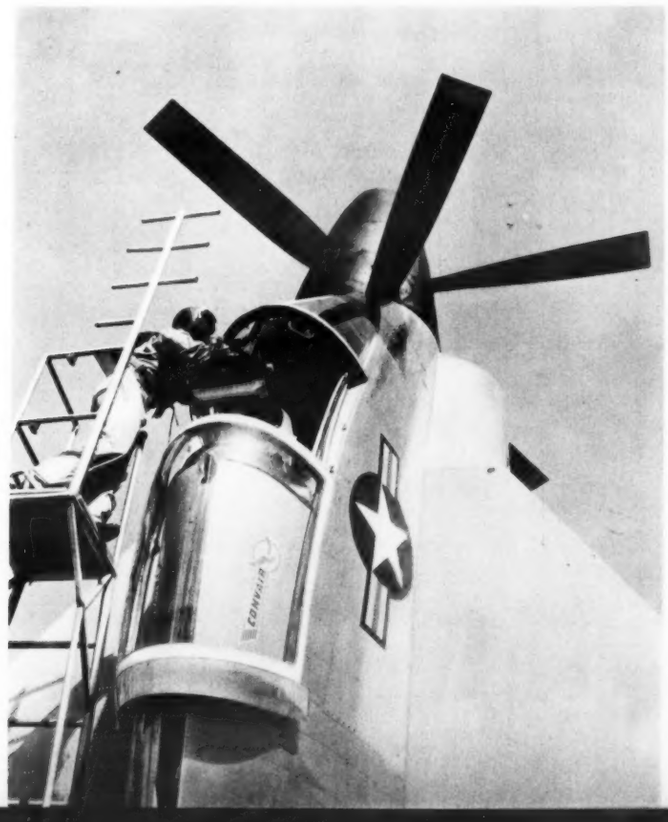
At the tips of its straight, thin wings the *Lockheed XFV-1* carries large auxiliary fuel tanks, no doubt also rockets. The squat fuselage houses an Allison T-40 turboprop engine of 5,500 e.s.h.p. driving contra-rotating propellers. Eventual production models, it is reported, would be fitted with the Allison T-54 turboprop of about 7,500 e.s.h.p. announced just recently. Lockheed says that Allison has built a "huge engine whose thrust is greater than the full take-off weight of the aircraft... which is twice the weight of the average fighter of World War II" (i.e., 14,000—20,000 lbs.— Ed.—). Even should one of the twin power sections fail, the other would keep the aircraft in flight and land it safely...

The way "Vertical Risers" are designed to work is shown in this artist's view of a batch of Lockheed XFV-1 turboprop-powered target-defence fighters taking off from within industrial plant area. Rocket power will probably be used to provide initial acceleration.

While no control surfaces are visible on the wing, all four fins of the cruciform empennage have both control surfaces and trim tabs. The tail fins also carry the four shock absorber legs and the four small wheels on which the aircraft rests. The undercarriage shown in one of the pictures does not belong to the aircraft but is used for preliminary tests from the horizontal position and for maintenance and ground handling. A special trolley is used to tilt the aircraft into the take-off position, and the pilot has a swivelling seat to enable him to assume a semi-upright position in vertical flight.

Convair XFY-1 vertical take-off delta wing fighter rests on casters attached to tail surfaces and wing tips. The aircraft is estimated to have a take-off gross weight of about 20,000 lbs.

Pilot gets to his cockpit by climbing up a specially-built ladder. Pilot seat swivels, to give pilot semi-upright position in vertical flight. This is Convair XFY-1.



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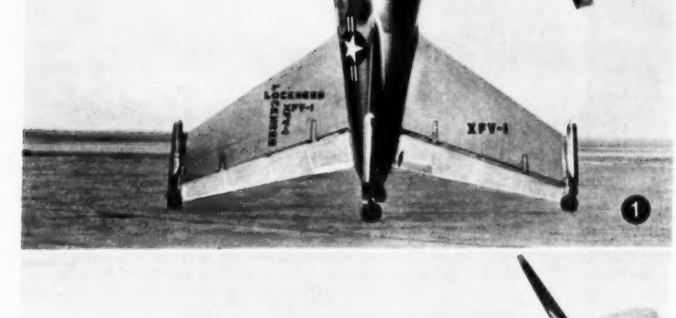

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Performance details are not available at this writing, except the indication that cruising speed in level flight is about 500 m.p.h. and that a maximum speed of 700 m.p.h. is being aimed at. The prototype has not yet started actual flight tests, but some time ago it did make a short horizontal hop from its provisional undercarriage. The test pilot will be Lockheed's Herman "Fish" Salmon.

The delta-wing *Convair XFY-1*, "sister ship" to the Lockheed fighter, is also powered by an Allison T-40 turboprop of 5,500 e.s.h.p. and contra-rotating propellers. The Convair fighter's wing tip containers probably carry no fuel but house the armament. The XFY-1 has only two tail surfaces, arranged at right angles to the wing. These carry shock struts and small wheels, and two more wheels are fitted at the wing tips. Both the Lockheed and Convair models thus take off from and touch down on four points on the ground. Performance of the Convair model may be assumed to be similar to that of the Lockheed type.

The vertically rising fighter will "fight, fly, land and take off like a humming bird," says J. F. "Skeets" Coleman, the man who will test-fly Convair's XFY-1 fighter. "No other aircraft ever built can approach it for manoeuvrability and change of pace—it'll go from a hover to fighter speeds in seconds."

Because no one has flown such an aircraft before, both Convair and Lockheed have devised special installations for initial testing of their new models. Inside a roomy balloon hangar at Moffet Field, near San Francisco, Convair engineers have built a tethering rig for the XFY-1's "vertical taxi" tests, in which the machine will be suspended from a cable attached to its nose to prevent it from dropping back to the ground. Guide cables will run from the wing and fin tips to the hangar floor. The tension of the cables will be adjusted, so that the aircraft will respond to the pilot's throttle movements but will never be out of control from the ground. Only after the pilot has familiarized himself with the new techniques in weeks of tethered tests will he be allowed to take the machine up on a full-scale test flight.

There has been much speculation about how the novel aircraft will take off and land. Some sources have suggested that they will start vertically with the help of auxiliary rocket power; landing might be effected by placing the machine in a vertically upright attitude, cutting the engine and ejecting a parachute from the very large propeller hub fairing—thus gently lowering it to the ground. On the other hand, rockets—either conventional JATO or liquid-fuel rockets—could be used not only for take-off but also to create a "cushion" during landing. Furthermore by inserting rudder vanes in the rocket jet, a measure of pilot control at the slow speeds directly after take-off and prior to landing could be provided.

The idea of vertical take-off interceptors for the protection of vital targets is not new, but the propeller-driven and vertically landing variety is. Towards the end of World War II, the Germans were experimenting with a rocket-propelled interceptor, the *Natter*, which was designed to take off from a ramp, intercept the target and crash to earth after the pilot had bailed out by parachute. In Britain a general programme of research in the same field was instituted by the Government some years back, and Fairey Aviation has carried out tests in Australia with a rocket-powered delta-wing scale model. Several other British firms have been interested in vertical take-off interceptors, although not with propellers. In France, Bréguet has been known for some time to be working on the design of a VTO fighter using jet propulsion.

In the light of the usual American practice, the fact that a rash of pictures of the two "cosmic secret" vertical risers has suddenly been released indicates that—although neither of the machines has made a full-scale test flight yet—both the designs are already considered as obsolescent by U.S. top naval brass. This would hardly be surprising,

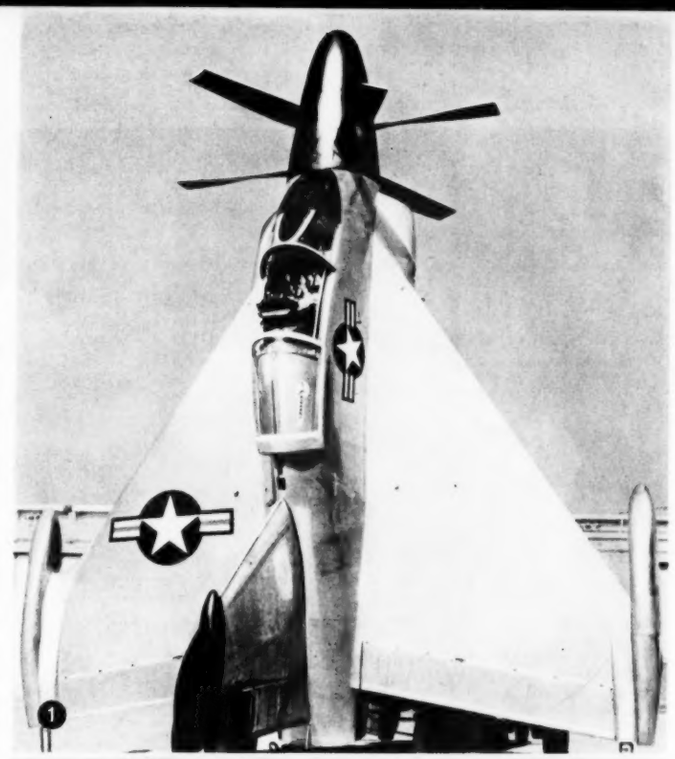
(1) Lockheed XFV-1 vertical take-off (and landing) fighter stands on small wheels and shock struts attached to tips of X-shaped "double-butterfly" tail. Note absence of control surfaces on wings, control surfaces and trim tabs on empennage. – **(2)** XFV-1 vertical riser on special trolley used to tilt it into vertical position. Pilot is aboard. – **(3)** Lockheed XFV-1 in horizontal position on provisional landing gear from which it made initial test hop. Photo shows cruciform tail.

since both models were ordered more than three years ago. Such an attitude would obviously not mean that other developments along similar lines are not in progress, and these developments would no doubt aim at increasing the aircraft's combat performance and ease of operation.

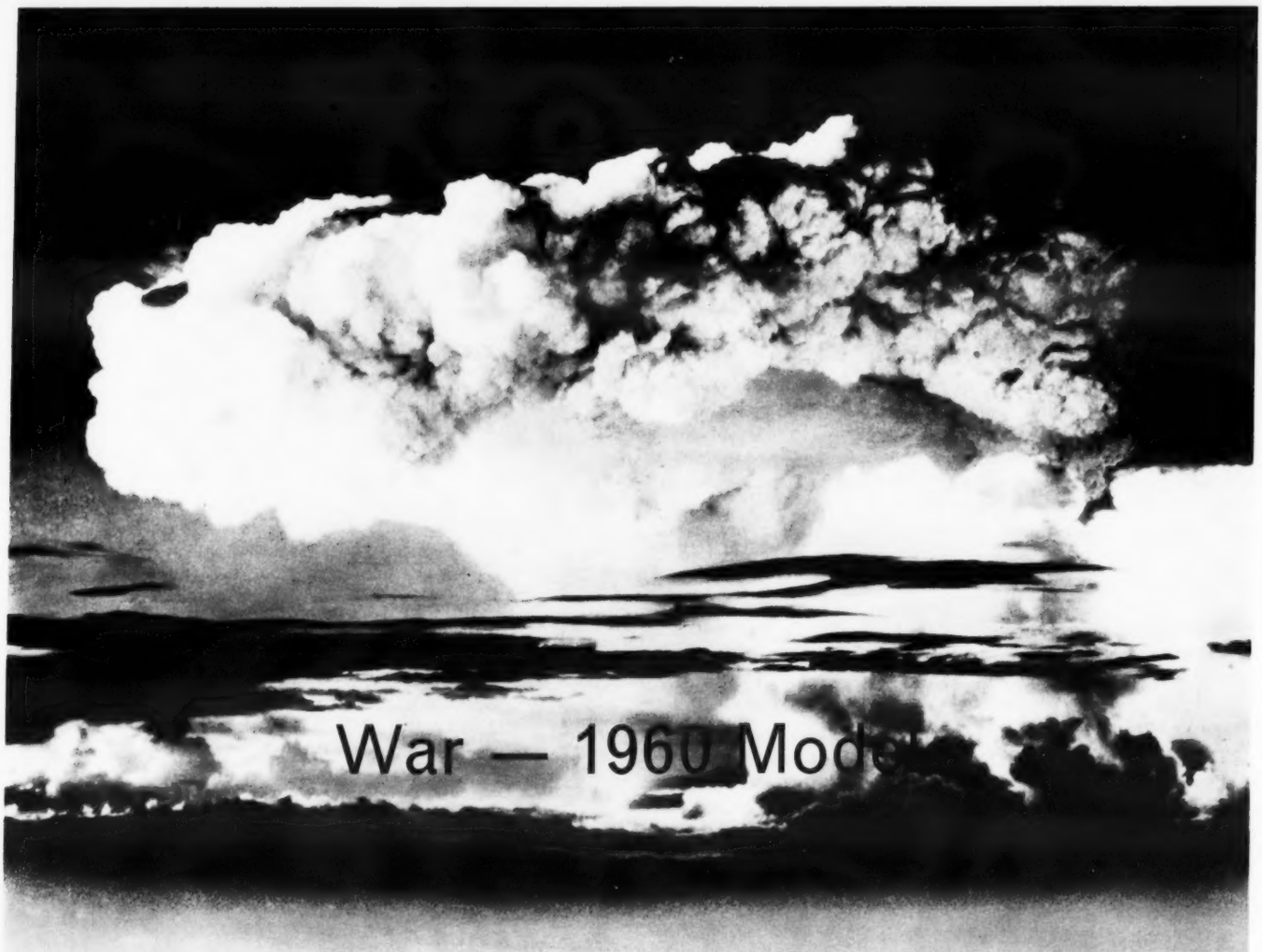
Confirmation of the view that the present prototypes are outdated is seen in the sceptical reception which they have received—outside of the popular press—in American industry and military quarters. A recent press conference at Convair in the presence of a Navy representative produced an interesting query: "What will the vertical rise fighter do that guided missiles such as the 'Nike' can't do better?" The Navy spokesman's brief reply to an evidently uncomfortable question was to the effect that "missile intelligence" had not yet proved an adequate substitute for the human pilot.

Obvious problems of the ship board vertical riser include those of take-off from a sharply pitching take-off platform; of smoothly settling down to a tail first landing on a violent deck in unpredictably turbulent air sweeping over the vessel; of keeping the aircraft from toppling over under influence of deck pitching and wind gusts. Another aspect of the vertical riser not cited in publicity releases is that in the event of power failure the pilot would be practically forced to bail out by parachute, since his aircraft carries no conventional landing gear. It may be possible that, as mentioned previously, the aircraft could be lowered to the ground by its own parachute, though this would seem hazardous if attempted from great heights. Furthermore, provision could be made for a device to release or blast loose the long downward extending tail fins at the final instance of a conventional belly landing. Without such provision the venture would certainly end in disaster: the fins would snag the ground or carrier deck and throw the aircraft violently forward on to its nose.

The two aircraft apparently were built as a result of a Navy design competition envisaging a production order for the winner if free flight tests were successful. If the projects were to be abandoned in the experimental stage, they would have formed an expensive excursion into the realm of "fantastic" flying. The Navy has signed a chit for $8,000,000 for the Convair research and development order and is reported to have invested $12,000,000 in the Lockheed design.



(1) Convair XFY-1 delta-wing vertical riser. Size of aircraft can be judged by arm and hand of pilot in cockpit. Forward tilt of ejector seat is clearly discernible. – (2) Convair also developed special mobile vehicle for transporting, raising and lowering Navy's XFY-1 vertical take-off fighter. Horizontal position is desirable for easier maintenance. – (3) Convair VTO fighter in horizontal position on trolley. Wing-tip container probably houses armament. In background three Convair R3Y-1 *Tradewind* four-engined turbo-prop-powered transport flying-boats being produced for Navy (cf. *Interavia* No. 2 1954). – (4) In flight gear Convair test pilot J. F. "Skeets" Coleman poses beside new XFY-1 vertical take-off fighter. Because no vertical take-off *and* landing fighter has ever been flown before, Convair engineers built special rig in balloon hangar at Moffet air base to permit "tethered" take-off and landing tests.



War — 1960 Mod

Plutonium bombs, hydrogen bombs and cobalt bombs, guided missiles, poison gas and germs will be inflicted on the world if the civilized nations decide to become involved in World War III—around 1960-65, or so.

This frightening prospect is sketched in a 60-page survey compiled by the Swedish Defence Staff, headed by General Åkerman, on the weapons that may be expected to be in general use six to ten years from now—in addition to "conventional air, land and naval weapons". Although it contains information of wide general interest, the survey states that for reasons of Swedish national security many vital problems are alluded to only very superficially.

Actually, the survey makes no sensationally novel statements. It simply assembles, in sober military language, a brief description of the developments that are known to have been going on for some time. The effect of this compilation is awesome, nevertheless, and some Swedish newspapers have described the study as "fantastic" and "of the Jules Verne kind". This is hardly applicable, since the survey deals chiefly with realities and only secondarily with possible future perspectives.

A summary follows below.

Nuclear Weapons

One of the most interesting sidelights of the study is the hint by General Åkerman that the manufacture of atomic bombs is no longer a monopoly of the Great Powers. In fact, says the General, smaller nations will probably soon be qualified technically to produce nuclear weapons, provided the necessary raw material is available. This and other recent statements are interpreted in Sweden as meaning that Sweden is now actively planning the manufacture of atomic bombs. Some experts even go as far as hinting that Sweden will have her own atomic bombs and guided missiles by 1958-62.

There is no reason to believe, the survey states in the 14-page chapter devoted to nuclear weapons, that scarcity of uranium should materially reduce the production of atomic weapons in the world. Whatever the methods used to produce the explosive for conventional atomic weapons, the main factor deciding the scale of atomic bomb production is the industrial investment that is required.

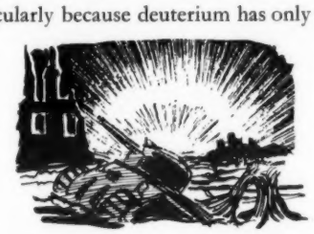
Atomic bombs are either of the *heavy variety,* weighing about five tons, which can be carried only in large aircraft such as the U.S.A.F.'s Convair B-36, Boeing B-47 *Stratojet,* B-50 *Superfortress* and B-52 *Stratofortress,* the R.A.F. Vickers *Valiant,* Avro *Vulcan* and Handley Page *Victor,* and the Soviet Tupolev T-4 (significantly, the Swedish Defence Staff mentions none of the mysterious Russian giant bombers recently publicized in the Western press.—Ed.).

Lieutenant-General G. R. J. Åkerman has been the Chief of the Swedish Försvarsstaben (Defence Staff) since 1952 and in this capacity supervised the compilation of the "War in 1960" report summarized below. Originally an Army Officer, General Åkerman in 1948 was appointed Chief of the Air Warning Inspectorate (Luftbevakningsinspektionen) when it was transferred from the Army to the Air Force. The Defence Staff's main duty is to prepare operational plans in case of war, to coordinate the work of the three Services and provide liaison between the military and civil authorities.

Light atomic weapons comprise the tactical A-bomb which can be carried even by single-engined jet aircraft (e.g., the Republic F-84 *Thunderjet* fighter-bomber), atomic warheads of guided missiles and atomic artillery shells. Present American atomic gun shells, which are fired with ordinary gun powder from a large but conventional gun, have a calibre of 28 cm and a range of about 30 km (20 miles).

The light atomic bomb weighs only a few hundred pounds, and fast tactical jet aircraft can penetrate a strong air defence more easily.

The *hydrogen bomb* is based on a different principle from the conventional A-bomb, namely, on the synthesis of two light materials, tritium and deuterium, with a conventional A-bomb being used as a "detonator". Production of the H-bomb is difficult and costly, particularly because deuterium has only a short



lifetime: over a period of twelve years half of a given amount of deuterium is transformed into other products. Tritium is produced in the same type of reactor as plutonium, as a result of which plutonium production capacity must be reduced. In principle, the effect of the H-bomb is similar to that of the A-bomb*.

The *cobalt bomb* which has been mentioned in the press from time to time is another matter. In this type of bomb the effect aimed at is less the explosive effect than the production of radio-active material, which is several times greater than in atomic bombs of other types. The particles from a cobalt bomb are spread in a cloud of radio-activity which would make large areas impassable for a long period. However, use of this weapon would probably be as disadvantageous to the attacker as to his victim, for the radio-active particles produced by cobalt have so long a lifetime that the attacker's own operations might be hampered. Furthermore, the course of the radio-active cloud is difficult to predict, which creates serious risks for the civilian population—enemy or friendly.

Atomic bomb design continues to be improved. The heavy conventional plutonium bombs tested recently by the U.S.A. probably contain sufficient energy to affect an area twice as large as those affected by the Japan bombs. Light A-bombs and atomic warheads of guided missiles will shortly attain an effect corresponding to that of the Japan bombs, while the effect of present atomic artillery shells is about half or three-quarters that of the Japan bombs. In future, atomic explosives may be used in shells of smaller calibre, in sea mines and torpedoes.

Improved production methods and large-scale manufacture will materially reduce the cost of A-weapon manufacture. Cost of the various types will probably differ little, since the explosive itself accounts for most of the expense. With the exception of atomic sea mines and torpedoes, all A weapons (plutonium) mentioned above are already in existence in the U.S.A. It is believed that some of the lighter types of weapon are not yet available in Soviet Russia, but their development is merely a matter of time.

The U.S.A. is reported to have more than 1,000 conventional atomic bombs in storage, the Swedish survey states, and America's production capa-

city is estimated at several hundred a year. Production and stocks are constantly being increased, and stocks can be expected to multiply five or ten times (to 5,000 or 10,000 bombs!—Ed.—) by 1960. *The Soviet Union is believed to have a few hundred bombs at present and a capacity of about one hundred heavy and light bombs a year,* but a more than tenfold increase is possible by 1960. *Great Britain's* stores of A-bombs are small but are increasing at a steady rate.

Unlike the conventional A-bomb, whose size is limited by the critical mass of fissionable material required, there is no theoretical upper limit to the size of the H-bomb, apart from the limits imposed by problems of transportation. As things stand at the moment, present H-bombs can be carried only by the very largest bombers, such as the Boeing B-52.

Another method of using the atom in war is in the form of radio-active contamination. By about 1960 the United States and the Soviet Union, the survey estimates, will have "some hundreds of kilos" of plutonium that can be used for this purpose, whereas the resources of other nations will be small. Contamination weapons of this kind have a short lifetime, however, so that stores will always be limited. At the same time, relatively large amounts will be required to exterminate people dispersed in the open, but only small quantities of radio-active materials will suffice to contaminate limited areas such as factories, harbours and fortresses.

Germs and Gases

Calmly the Swedish Defence Staff proceeds to examine further potential horrors of a possible World War III.

* *Editor's note:* The type of effect is similar, but not the extent, as recent American H-bomb tests have shown. On March 1st, 1954, the U.S. Atomic Energy Commission exploded an H device in the Marshall Islands as a rehearsal for the "full-dress" air-borne H-bomb explosion of March 26th. The effect of the explosion was unexpected (reportedly it produced an initial cloud 46 miles in diameter) and resulted in a number of well publicized radiation casualties among U.S. scientists, natives and Japanese fishermen far from the site. The A.E.C. then reclassified the first American H explosion on November 1st, 1952, as a "misfire". Its cloud measured "only" 28 miles in diameter and its force was estimated to be equal to that of 250 Hiroshima-type A-bombs of World War II. The "dress-rehearsal" explosion of March 1st, 1954, was said to be equal to about 500 Hiroshima-type bombs . . .

Germ warfare is likely to be used on a wide scale in a future "all-out" war, and this is an extremely important eventuality to guard against*.

Gases continue to play an increasing role in any nation's defence preparations, although they have not been used in recent wars. Only small quantities of modern gases are required to provoke severe poisoning or wounds upon contact, and they can therefore be spread out from aircraft many miles distant from the target. Particularly frightening are nerve gases because they incapacitate their victims so quickly that protection based on symptoms is not possible. Arrangements for artificial respiration and atropine injections are a defence against certain nerve gases, and devices have been elaborated to enable a victim to make atropine injections himself.

Fire weapons

"Old-fashioned" weapons like incendiary bombs are the subject of the next chapter of the Swedish study. The evolution of the aeroplane made the mass use of incendiary bombs possible, and vast quantities of thermite, magnesium and phosporus bombs were dropped during World War II.

Towards the end of the hostilities another effective incendiary weapon, jellied gasoline or "Napalm", was introduced and subsequently widely used by the U.S.A.F. in Korea.

Over periods of several minutes napalm can create temperatures of over 1,000°C. It can be employed in flame-throwers carried by hand or in armoured vehicles. *The napalm bomb today is the most efficient weapon against troops and ground equipment.* From two to six bombs, each containing 100 to 150 U.S. gallons of napalm, can be carried by modern attack aircraft, which release them in level flight or in a shallow dive. On the other hand, armoured vehicles, gun positions and even troops are relatively easily protected against napalm attacks. In Sweden, for example, coastal artillery positions have continued firing while under napalm bombardment.

Missiles

Long-range ground-to-ground missiles of improved V-1 and V-2 varieties, short-range ground-to-ground missiles, anti-tank missiles, air defence missiles, fighter missiles, light and heavy "artillery" missiles, naval missiles and coastal defence missiles will be in use in the 'sixties. *V-1 type missiles will have a range of about 1,000 km (620 miles) and sonic speeds.* Accuracy will have improved so that this type of weapon can be used not only against cities but also such targets as air bases, railway centres and industrial areas. *V-2 type missiles* will have ranges up to 500-600 km (300-370 miles); however, their accuracy will continue to be poor, and they will therefore be employed only in terror attacks on large cities. *Intercontinental missiles* are probably twenty years away.

Ground-to-ground missiles are likely to be used on a wide scale against large tactical targets to supplement attack air operations and long-range artillery bombardment. Missiles with atomic warheads and biological weapons are to be expected, but gas-carrying missiles will probably not be employed other than for terrorizing purposes.

Anti-tank missiles will have a range of some kilometres. Anti-aircraft missiles will be developed with longer horizontal ranges (which will require improved guidance). Such "pilotless fighters" will take a long time to develop, however, and air defence missiles will be used initially only against very high-flying aircraft. The increasing difficulties encountered by manned aircraft in reaching the enemy before he releases his bombs and destroying him with machine guns, cannon and rockets emphasizes the requirements for better precision, range and effect of fighter missiles. The present tendency is against arming all fighter aircraft exclusively with missiles.

Methods of defence against missiles are also being developed. No protection against attack by V-2 type missiles is known at present, however.

Electronics

It is a commonplace that electronics will play an enormously important part in a future war, but certain parts of the Swedish survey are nevertheless of interest:

If supersonic fighters are used against fast enemy aircraft, *completely automatic fighter direction is indispensable.* Even day fighters must carry radar to detect their targets, especially when the enemy is jamming radio communications between the fighter and its base. Attack aircraft will also have radar to find vessels and other surface targets. Radar bomb sights will increase bombing accuracy.

Fire control radar will make possible complete automatization of even light anti-aircraft artillery.

Because of the ever-increasing dependence on radar and other electronic equipment in war operations, it is *important to prepare large-scale jamming and interference measures.* These measures must be based on knowledge of the type of enemy stations and equipment to be disturbed.

* *Editor's note:* The British Ministry of Supply has announced that it is testing defensive measures against bacteriological war; new tests will be held during 1954 in an area off the Bahamas, in the Atlantic, following initial trials off the coast of Scotland.

The concluding chapter of the survey forecasts the developments that may be anticipated in military aircraft by 1960.

Heavy jet bombers will operate at sonic speeds at altitudes of 15,000 to 20,000 m (50,000—65,000 ft.), and rockets will be used for brief spurts of speed. Supersonic bombers will be in the design stage.

Jet-propulsion will mean either reduced range or reduced bomb carrying capacity, although the H-bomb will require greater load-carrying capacity from heavy bombers. Conventional A-bombs will not increase the load-carrying requirement.

In-flight fuelling will come into general use. The high altitudes will necessitate new navigation and bombing methods and new bomb types. Radar bomb sights will make possible bombing independent of visibility conditions. Guided missiles will be launched from bombers in precision attacks.

Medium bombers will follow the same lines as heavy bombers, but reduced range requirements will make supersonic operations possible in a few years. Flight refuelling will be used to increase medium-bomber range, and this type of aircraft will also carry the A-bomb.

Ground attack aircraft will not operate at supersonic speeds in the next few years due to stress and cooling problems at altitudes below 15,000 ft., even though they will be capable of supersonic flight at greater altitudes. They will carry radar sights and use guided missiles, rockets and bombs against naval and ground targets.

The piloted fighter will not be replaced by missiles in the near future, but air defence missiles will supplement the defence of the fighters against bombers at great heights. Fighters will retain their superiority over bombers in battle, with top speeds of Mach 1.5 or 2.0. Rate of climb will grow, ceiling will increase to 20,000 m (65,000 ft.). Jet turbine fighters may later be replaced or supplemented by rocket-powered fighters operating at Mach 3.0 at between 20,000 and 30,000 m (65,000 and 100,000 ft.).

Fighter armament will increase to 30-mm calibre or more but will be supplemented—and later on, perhaps replaced—by target-seeking missiles, the most efficient future fighter armament.

*

The survey concludes with the statement that a country's technological deficiency will be its greatest weakness in a future war. This applies to a small country even more than to a large nation. Sweden's military authorities are fully aware of this fact, and Sweden is carrying out research and development in all the fields alluded to above.

This photo, made at a height of 12,000 feet 50 miles from the burst, shows the cloud formed by the detonation of the "Mike" hydrogen bomb at Eniwetok Atoll, Marshall Islands, in the autumn of 1952. The "fireball" measured three and a quarter miles in diameter. Two minutes after the detonation, the cloud had reached a height of 40,000 feet. Ten minutes later, the stem of the cloud had pushed 25 miles in the stratosphere. The mushroom part went up to ten miles and then spread out for 100 miles. The test islet of the atoll completely disappeared, leaving a sea-filled crater a mile across and 175 feet deep in the centre. The U.S.A. detonated much more powerful H-bombs on March 1st, March 26th and April 6th of this year.

New Landing Aid on Aircraft Carriers

General view of the system: A – mirror and coloured lights; B – white lights reflected as a spot by the mirror.

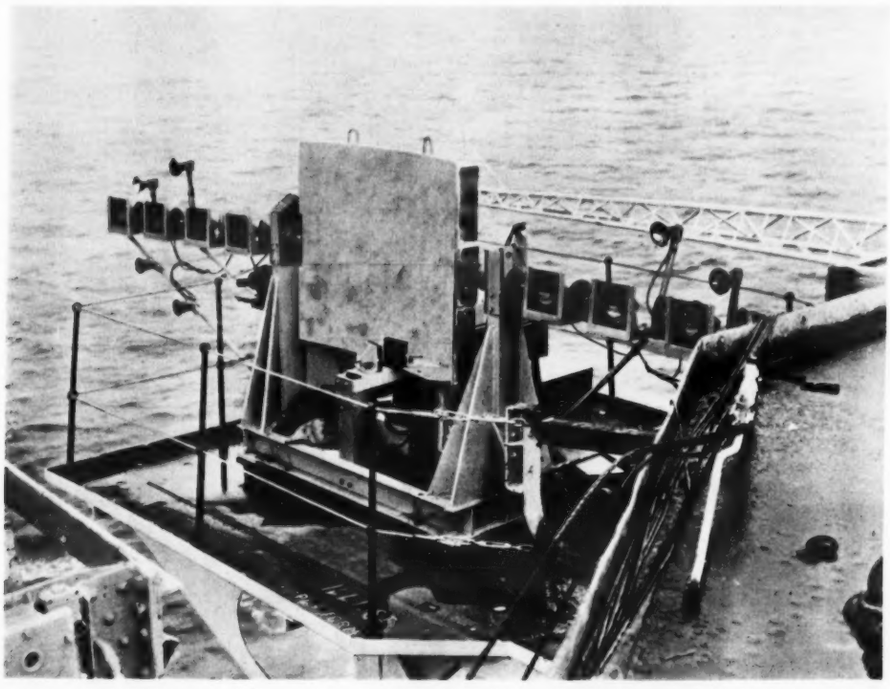
The much higher approach and landing speeds of modern jet carrier-based naval aircraft makes the landing signals officer's task of safely bringing them in to land almost impossible.

The Royal Navy, which has already brought out two major innovations for aircraft carriers—the steam catapult and the angled flight deck*—during recent years, has therefore been making trials with a new visual device for directing the approach and landing of carrier-based aircraft. This device, originally suggested by Commander (Engineering) H.C.N. Goodhart of the Royal Navy and constructed at the Royal Aircraft Establishment, Farnborough, in collaboration with the Admiralty and the Ministry of Supply, takes over the job of the batsman.

It consists of a concave mirror facing aft, a set of coloured lights on either side of the mirror and a set of white lights arranged further aft so as to reflect from the mirror as a single spot. The mirror is stabilized by a gyroscope system which keeps it at a constant angle in relation to the horizon. If the pilot of an aircraft approaching to land sees the white spot in line with the two rows of coloured lights, he knows that he is at a correct angle to the deck. If the white light is too high or too low, he knows he must correct his angle of descent. Because the pilot cannot watch his instruments as well as the mirror, a special reflector on his windscreen shows him a green (correct speed), red (too fast) or yellow light (too slow). These lights are controlled by his air speed indicator.

The landing aid was fitted in the aircraft carriers *Illustrious* and *Indomitable* for trials about eighteen months ago. Several hundred trial landings have already been made, many of them by naval turbojet and turboprop aircraft such as the Fairey *Gannet* and the Westland *Wyvern*. Representatives of the United States and Canadian Navies attended one series of trials, and it is expected that the U.S. Navy, which has already adopted the angled deck and the steam catapult, will also introduce this visual landing aid.

*) cf. *Interavia* No. 3, 1953



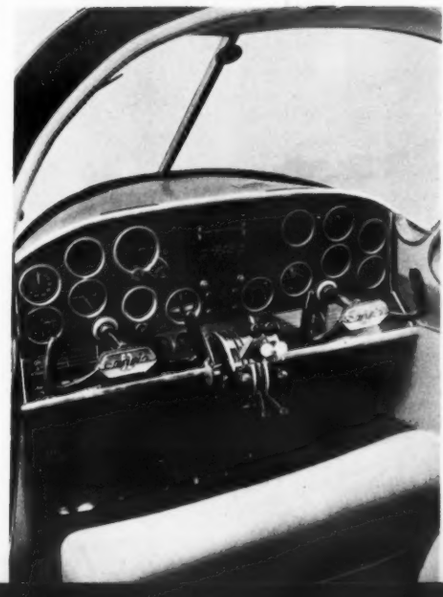
Main components of the landing aid are this gyro-stabilized concave mirror and the row of coloured lights on either side of it. The mirror collects and reflects white light from a set of lamps further aft. If the white spot is in line with the rows of coloured lights, the pilot knows that he is approaching the deck at the correct angle.

Mobile launching ramps for the Martin B-61 *Matador* jet-powered pilotless bomber can be carried over long distances by the Douglas C-124 *Globemaster 2*. Right-hand picture shows a launching ramp with B-61 in launching position. The take-off rockets discernible underneath the tail are jettisoned when they have burned out. — Two squadrons of *Matadors* have completed their tactical training at Cocoa Air Force Base, Florida, and one of them is now stationed in Western Germany, under the U. S. Air Force in Europe.

PROGRESS IN PICTURES

A treat for sports pilots: three-to-four seat Ambrosini-Frati F-7 *Rondone 2* (Italy). Fitted with a 90 h. p. Continental engine and Aeromatic v. p. propeller, it has a max. speed of 143 m.p.h. Service ceiling is 12,500 ft., and range 400 to 620 miles, depending on whether the type is equipped as a two-seater or a three-seater.—A 125 h. p. Lycoming engine is optional, in which case performance is higher: max. speed 165 m. p. h., service ceiling 14,800 ft., and range 435 to 620 miles (three or four-seater).

Cassio Muniz S.A., São Paulo (Brazil) began working on the *Casmuniz 52* twin-engined touring and executive five-seater about eighteen months ago. The makers announce that this machine, powered by 225 h. p. Continental engines, is to go into quantity production when its flight tests are completed. It will be used principally for air taxi services, training and small transport.



What's in the Air?*

AVIATION POLITICS

● Pacific in the news

U.S. Civil Aeronautics Board official Thomas Wrenn forecasts similar developments in Pacific air transport as have been taking place over the Atlantic since 1947. American airlines, which in 1952 carried 83% of all Pacific traffic, might expect stiff competition from Japan Air Lines, since a good proportion of all Pacific travellers are of Japanese origin. B.O.A.C. too might implement a route, to which it is entitled under the Bermuda agreement, from Hong Kong and Singapore to San Francisco, connecting there with New York and London.

Three more foreign airlines, Air India International, Linee Aeree Italiane and the Icelandic Loftleidir, have applied for authorization to fly to Japan. At present eleven international airlines operate to Tokyo-Haneda airport.

● South African restrictions on foreign air services

The Dutch protest against the reduction by South Africa of K.L.M. Royal Dutch Airlines' Amsterdam—Johannesburg services from twice to once weekly is being examined by Prime Minister Daniel Malan, a representative of the South African Transport Ministry announces. Negotiations are continuing. Reductions in the frequency of Scandinavian Airlines System and El Al services to South Africa will probably be discussed at the same time.

● New Soviet air base

The "newest and best equipped" Russian air base has been opened near Khabarovsk, Siberia, roughly 400 miles from Japan's main island Honshu and from Vladivostok, according to an official Tass statement.

SERVICE AVIATION

● Colonel Balchen visits AGARD

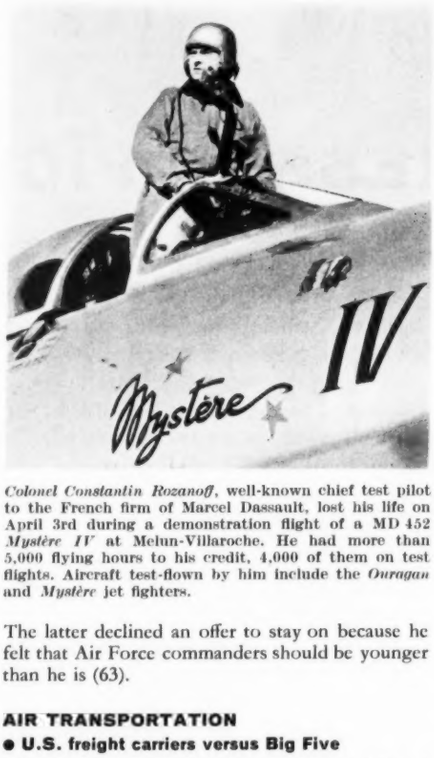
Colonel Bernt Balchen, the U.S. Air Force's expert on Arctic operations, is to go to The Hague in May to attend a meeting of the N.A.T.O. Advisory Group for Aeronautical Research and Development. He will read a paper on flying in Arctic regions (including northern Norway).

● A.L.P.A. Observer network

The Air Line Pilots Association has sent out special instructions to its 116 councils throughout the United States and overseas to set up a network of aerial observers. All American pilots are to report immediately through their union headquarters any sightings of possible military significance.

● New Swedish Air Force Chief

Major-General Axel Ljungdahl, 57, since 1949 in command of the Royal Swedish Air Force's No. 3 (Fighter) Group, has been appointed Commander-in-Chief of the R.S.A.F. He will replace Lieutenant-General Bengt Nordenskiöld, the "father" of the Swedish Air Force, who retires on July 1st, 1954.



Colonel Constantin Rozanoff, well-known chief test pilot to the French firm of Marcel Dassault, lost his life on April 3rd during a demonstration flight of a MD 452 *Mystère IV* at Melun-Villaroche. He had more than 5,000 flying hours to his credit, 4,000 of them on test flights. Aircraft test-flown by him include the *Ouragan* and *Mystère* jet fighters.

The latter declined an offer to stay on because he felt that Air Force commanders should be younger than he is (63).

AIR TRANSPORTATION

● U.S. freight carriers versus Big Five

The U.S. Civil Aeronautics Board has published a survey of American domestic freight traffic in 1953, which shows that the Big Five (American Airlines, United, TWA, Eastern, Northwest) recorded a total of 108,703,579 ton-miles, while the three pure freight companies (Flying Tiger, Slick, Riddle) reached 107,725,168 ton-miles.

	Ton-miles
American Airlines	52,319,534
	(+16% over 1952)
Flying Tiger	51,268,229
	(+24% over 1952)
Slick Airways	43,860,761
United Air Lines	27,620,390
Trans World Airlines	18,933,195

Leon Schoevaerts, Commercial Manager of Sabena, (left) who played a leading role in the development of Belgium's flag carrier, died in Brussels on April 1st. Schoevaerts, who created the first Brussels-Belgian Congo air service in 1935, was also a pioneer of tourist traffic. He is succeeded by *Paul Stouffs* (right).

Riddle Airlines	12,596,468
Eastern Air Lines	8,129,551
Northwest Airlines	3,701,009

● Air France increases passenger volume

Air France's operating figures for 1953 show 1,319,762 passengers, compared with 1,076,160 the previous year, an increase of 23%. This result was achieved despite the nation-wide strikes in August and the strike of air traffic control personnel in December, which involved a 6% decrease in tonne-km operated in 1953.

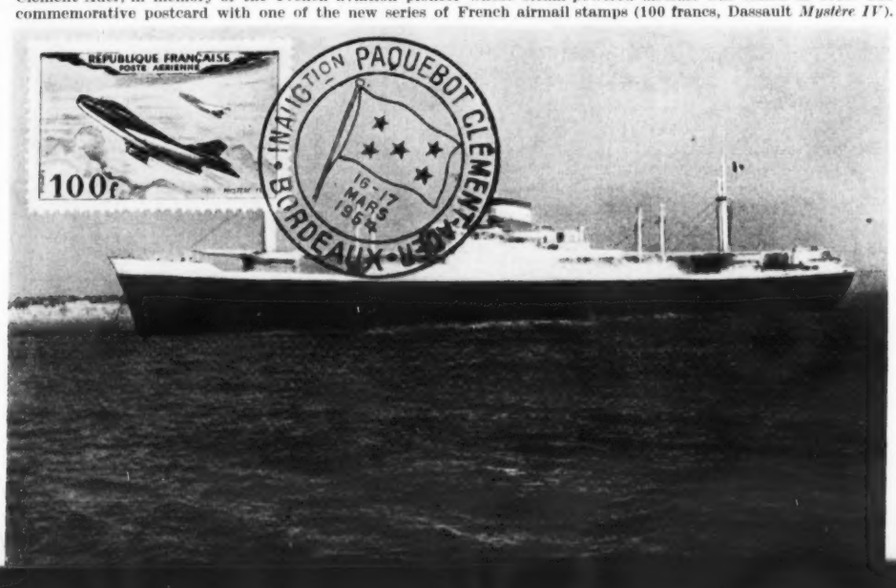
● British private carriers expanding

The 52 members of the British Independent Air Transport Association carried a total of 432,104 passengers in 1953, including 238,673 on scheduled services (95,7% more than in 1952) and 193,431 on non-scheduled operations (+ 66.3%), according to a review issued by the Association. For the first time the number of passengers using scheduled services exceeded those on charter and trooping flights. At the beginning of 1954 total fleet of the private airlines was 168 aircraft. B.I.A.T.A. states that its members have made 240 applications for the opening of scheduled services (71 domestic and 169 foreign) since the introduction of the Conservative Government's new civil aviation policy. Altogether 106 have been granted.

● K.L.M. sells Garuda shares

After months of negotiations K.L.M. has sold its 49% holding in Garuda Indonesian Airways to the Indonesian Government. The agreement signed in Djakarta by K.L.M. Deputy President M. J. van der Ploeg provides for K.L.M. to continue technical assistance to Garuda for six years. The agreement, valid until 1960, can be cancelled by either side on six months' notice.

Compagnie Maritime des Chargeurs Réunis, parent company of the U.A.T. airline, has christened its latest liner Clément Ader, in memory of the French aviation pioneer whose steam-powered aircraft was tested in 1890. The commemorative postcard with one of the new series of French airmail stamps (100 francs, Dassault *Mystère IV*).



* Extract from *Interavia Air Letter*, daily international news digest in English, French and German. All rights reserved.

The Fiat G. 80-3 B two-seat jet trainer has undergone acceptance tests at Caselle flight test centre.

● P.A.L. stops overseas services

Philippine Air Lines has announced, somewhat surprisingly, that it is to suspend all its foreign services (to Tokyo, San Francisco and Europe) and sell its Douglas DC-6s and DC-6Bs, "to avoid further financial loss." Bookings already received will be passed on to other companies, P.A.L. President Colonel Andres Soriano states. Regional services will be continued, using Convair 340s and Hiller 12-B helicopters. Personnel dismissals—300 employees of agencies abroad—will be inevitable.

INDUSTRY

● United Aircraft in 1953

United Aircraft Corp. has published final results for the 1953 business year (up to December 31st). Net profit amounts to $ 21,193,733 ($ 6.22 per share), compared with $ 17,809,391 ($ 5.18 per share) the previous year. Taxation reserves $ 48,507,846 ($ 33,609,732). Order backlog at the end of 1953 was $ 1,500,000,000 (beginning of 1953 $ 1,460,000,000).

● S. I. Sikorsky for Japan

Sergei I. Sikorsky, son of the well-known helicopter designer Igor Sikorsky, who has been United Aircraft Corp.'s representative in Germany, has now taken over United's office in Tokyo.

● Paris Air Show 1955

The Association of the French Aircraft Industry has decided to hold the 21st Paris Air Show in July 1955 at Le Bourget Airport, in the building erected for the 1953 Show. Maurice Heurteux was unanimously elected Chairman of the executive commitee, and André Granet will act as Commissioner General.

● Order of Lenin for Ilyushin

Sergei V. Ilyushin, the well-known designer of Russian jet bombers (for example, the Il-38 twin-jet tactical bomber) has been awarded the Order of Lenin, on his 60th birthday, for "outstanding services to Soviet aviation."

FLYING EQUIPMENT

● The first B-52A production model of the Boeing *Stratofortress* eight-jet (Pratt & Whitney J-57 of 10,000 lbs. take-off static thrust) heavy bomber has been completed at Boeing's Seattle, Wash., plant—with the exception of certain electronic equipment. The production model differs from the XB-52 and YB-52 prototypes chiefly in its modified pilot's cabin, which has seats side by side for pilot and co-pilot. The B-52A also is roughly 3 ft. longer than the prototypes.—Main dimensions announced: span 185 ft., length 156 ft., height 48 ft. Gross weight is more than 350,000 lbs. It will be recalled that the prototypes reached speeds of 650 m.p.h. during their test flights.

General Hoyt S. Vandenberg died of cancer, at the age of 55 on April 2nd, 1954. He was Chief of Staff of the United States Air Force from 1947 to April 1953. During World War II he particularly distinguished himself in the American landing in Africa and from 1944 on commanded the 9th Army Air Force in Europe.

● The first Convair C-131A *Samaritan* twin-engined transport and ambulance aircraft was delivered to the Military Air Transport Service at the end of March. The C-131A, derived from the *Convair Liner 340*, is normally equipped for 39 passengers (plus crew) or for 27 patients on stretchers. In the former case backward-facing seats are fitted.

● The first phase of the flight testing of the Lockheed XF-104 stripped single-seat fighter has been concluded at Edwards Air Force Base, Muroc, Calif. It is has a straight thin wing and Wright J-65 *Sapphire* turbojet engine.

● Republic *Thunderflash* is the designation of the RF-84F reconnaissance version of the Republic F-84F single-seat fighter. The Thunderflash carries its cameras in the nose; air intakes for the Wright J-65 *Sapphire* in the wing roots.

● From Australia comes the report that Commonwealth Aircraft Corp. has worked out a project for a twin-engined small passenger and freight aircraft, the *Wallaby*, with two 450 h.p. *Cicada* radial engines and a Turboméca *Palas* turbojet as take-off aid in the fuselage rear. Six passengers in luxury cabin, or 17 passengers for short-stage services.

● The first models of the *SIPA S.121* trainer are in final assembly.

● Four Fouga *Sylphe* light sports and training aircraft with Turboméca Piméné turbojet of 220 lbs. take-off static thrust are about to be delivered to the Sports and Light Flying Service.—Flight testing of the two Fouga CM. 170-R *Magister* jet trainer prototypes is continuing at Toulouse. More than 60 pilots from the United States, Britain, Holland, Italy, Germany and Japan have already flown the two prototypes.

● SNCA du Nord has signed an agreement to provide Société Boisavia with premises, tools and personnel at the Meaulte plant for the production of three Boisavia B-260 *Anjou* twin-engined touring aircraft. The three pre-production models and two others already under construction are to be completed by July 1954.

● The Japanese firm of Kayaba Kogyo K.K. (Kayaba Industrial Co.), known before and during the war for the design of rotary-wing aircraft and undercarriages, is assembling the first compound helicopter designed in Japan. Known as the Kayaba *Heliplane*, it has a jet-powered three-blade rotor (ramjet units by Ishikawajima Juko K.K.), stub wings, 180 h.p. Continental engine and two-blade tractor propeller in the nose, fixed nose-wheel undercarriage. Flight testing is to begin in the summer of 1954.—For a gross weight of 2,200 lbs., calculated max. speed in level flight is 106 m.p.h. cruising speed 75 m.p.h., service ceiling 9,840 ft. and range 250 km.

Boeing B-52 A *Stratofortress:* First production model of the eight-jet heavy bomber.

"Istanbul": Strapless cocktail gown with jacket designed by Shimamura and modelled by Fujiko Tanaka. "The surprise feature of the luxurious creation is the reversible coat." The luxurious creature inside the creation seems equally interesting.

"London": Dress and jacket ensemble designed by Oka and modelled by Mitsuko Morikai. "The elegance of this dress is achieved through its simplicity," says the official hand-out.

"Singapore": This silk dress and coat designed by Itoh and modelled by Mitsuko Morikai is described as "Nostalgia for the Orient". We aeronautical types learned with satisfaction that the "Chinese Mandarin coat . . . is worn over a shirt waist dress of shantung print of the Kasuri design . . ."

"Havana": Evening gown designed by Suzuki and modelled by Keiko Iwama. "Feminine and fluffy is this strapless, full-skirted dress of yellow silk organdy with tiny white polka dots . . . The exquisiteness of the creation calls for pearls" (follows joke about creature).

Flying Fashions 'Fifty-Four

Japanese fashion designers and Pan American World Airways got together a few weeks ago to transact some mutually beneficial business. They staged a fashion show.

On the face of it, the event was a fashion show like any other, except that it took place several thousand feet above ground. Probably there were other reasons for this unusual form of co-operation: P.A.A. saw an opportunity of convincing Japanese businessmen and their wives that its services to all parts of the world are a credit to the "worlds' most experienced airline". The company no doubt is fully aware of Japan's growing potential as an air transport market—and so are all the other Japanese and foreign lines operating to and from Japan.

The Japanese fashion designers—serveral of whom learned their trade in Paris—have seen enough of Western advertising methods to know that the "flying show" would be good publicity for their products—at home and chiefly abroad.

P.A.A. and the fashion experts had worked out a "suit-case" wardrobe fitting comfortably in the 66-lb. baggage limit on the company's first-class trips. The wardrobe consisted of five evening gowns ("although only one is considered necessary for modern lady Magellans of the airways"), whereas the remaining thirteen numbers were "designed to fill the basic needs of the air traveller—with weight left over for souvenirs and trinkets along the way." All eighteen creations bore the names of cities along P.A.A.'s network of air routes: Tokyo, San Francisco, London, Honolulu, Brussels, Rio de Janeiro, Guatemala, Lisbon, Nice, Lima, Havana, Bangkok, Manila and Rome. The locale of the show was a Boeing *Stratocruiser* flying over Japan, and the fashions were presented (naturally) by some of Japan's "most beautiful girls".

On this page are five of the fashions shown. It seems that there also was a "bathing ensemble" called Honolulu . . . but *Interavia's* Tokyo correspondent failed to send the picture. It is suspected that he is a pin-up addict.

"Lisbon": Sundress (we nearly omitted the "s" at the beginning) with bolero designed by Shimamura and modelled by Harumi Imura (for telephone number, apply to the Editor). Shimamura served her dress designing apprenticeship in the shops of the *haute couture* in Paris. — The hand-out says that the dress has a "Chinese collar". We like Chinese collars.

Can't seem to leave the subject of Japanese fashions. This one has nothing to do with the fashion parade, it merely shows two Tokyo belles in a *Comet* airliner. Yes, the garments are kimonos.

The Paris Area Control Centre and its Equipment

BY JACQUES VILLIERS, AIR NAVIGATION ENGINEER,
SECRETARIAT OF STATE FOR CIVIL AND COMMERCIAL AVIATION, PARIS

Annex 11 to the Chicago Convention on International Civil Aviation states that in areas of dense air traffic it is essential that aircraft be controlled from the ground and that Contracting States should provide appropriate units for this purpose. The objectives of these air traffic services, it further states, must be to :

— prevent collisions between aircraft ;
— expedite and maintain an orderly flow of air traffic ;
— provide advice and information useful for the safe and efficient conduct of flight ;
— notify appropriate organizations regarding aircraft in need of search and rescue aid, and assist such organizations as required.

*

The Paris area has all the conditions necessitating the provision of air traffic control organizations. Traffic is made up of flights by all categories of aircraft (civil and military) with very different performance, from the single-engined private aircraft to the long-range four-engined airliner with conventional power plant, as well as jet and turboprop aircraft.

The diversity of cruising speeds and altitudes greatly complicates the problem of separating aircraft in time and space. The density of the traffic to and from Paris, and the large number of both civil and military training flights make the Paris area into one of the big cross-roads of air traffic in Europe. The curves in *fig. 2* illustrate these considerarations and show the constant increase in traffic directed by the Paris Area Control Centre.

Ensuring an orderly flow of traffic presents special difficulties because of the frequently unfavourable weather conditions. Aircraft are more often than not obliged to fly by Instrument Flight Rules, and pilots, unable with their own resources to prevent collisions, must leave to the ground operators the task of working out route and altitude and, perhaps later, speed, within the framework of the projected flight plan and the pre-determined procedures.

The presence of two large international airports (Orly and Le Bourget) one on either side of Paris, each used by aircraft arriving from both north and south, renders the problem of overlapping routes a complicated one. Routes themselves also frequently have to be diverted to avoid prohibited military training areas.

Role and functioning of the Area Control Centre

Aircraft within the Flight Information Region receive information and instructions needed to ensure safe, efficient flight. Within the region there are privileged zones formed by the Paris terminal area and the main airways : no aircraft may fly here under I.F.R. without keeping constantly in touch with the Area Control Centre *(CCR = Centre de Contrôle Régional)* responsible for the safety of flight in these airspaces. However, the CCR has entrusted the control towers with the task of staggering aircraft in the airports' traffic zones (approach control).

The services of both the Flight Information Region and the Area Control Centre are combined in a unit known as the *Centre de Contrôle Régional Nord* (CCR/N), which also provides alerting and rescue services *(fig. 3)*.

*

In order to perform its set task, the Area Control Centre must be notified in advance of all flights planned. The Central Telecommunications Office *(Bureau Central des Télécommunications)*, next door to the Centre, handles service messages by teletype, radio-teletype and W/T, and special direct lines place controllers in immediate contact with their colleagues in neighbouring control centres and approach controls.

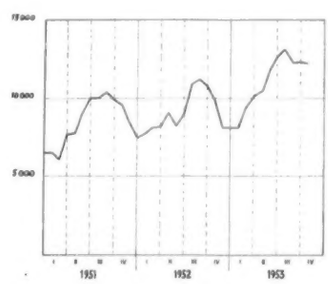


Fig. 2 : Graph of aircraft movements under Instrument Flight Rules controlled by the Paris Area Control Centre (CCR/Nord).

Aircraft in flight announce their position and receive instructions

— by HF W/T (sometimes also by HF R/T) when the aircraft is in the F.I.R.
— by VHF R/T in terminal areas and on the majority of controlled airways.

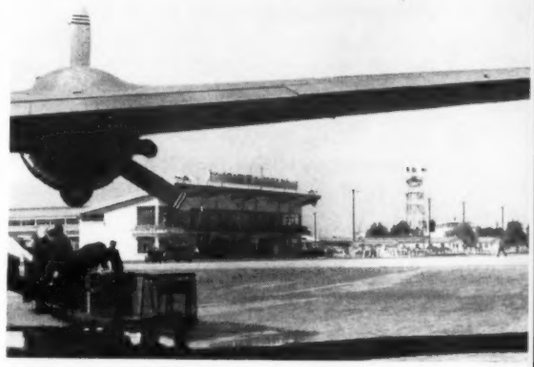


Fig. 1 : Orly Airport : mast and aerial of Paris Area Control Centre's long-range surveillance radar.

Present plans call for VHF facilities to be extended to cover all airways with major traffic by means of relay stations.

The information received enables the estimated position of all aircraft reported to be established. A progress strip is filled out for each aircraft and filed horizontally on special desks in such a way that the portions of all strips referring to a given major reporting point are in the same vertical column whatever the aircraft's route. The estimated time of flight over this point and the last altitude notified are marked up for each aircraft in the appropriate space on its progress slip and kept up-to-date. With suitable training, the controller can interpret with a single glance the present and future coordinates of every aircraft within the airspace under his control. This enables him to issue the instructions needed to maintain suitable distances between the aircraft under his care and to come to an agreement with neighbouring units on these instructions.

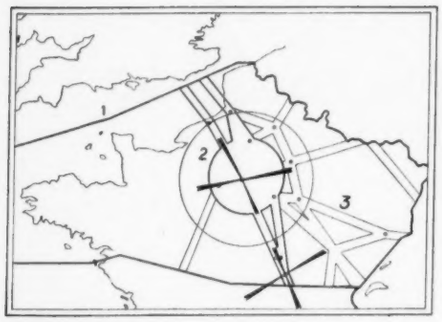


Fig. 3 : CCR/Nord's control sectors. 1—boundary of Flight Information Region ; 2—Paris terminal control area ; 3—airways.

Fig. 4 : The Area Control Centre houses six independent desks, each exploring a different sector. Three of the desks are seen here.

Aircraft in flight are staggered laterally (on different routes), longitudinally (suitable distance between aircraft on the same route) and vertically (different altitudes).

The object is to create a " block system ", with a space round each aircraft into which no other aircraft may penetrate. The complexity of the problem can be readily imagined, especially at points where several airways cross and where some aircraft are climbing to cruising altitudes, others flying level and still others descending.

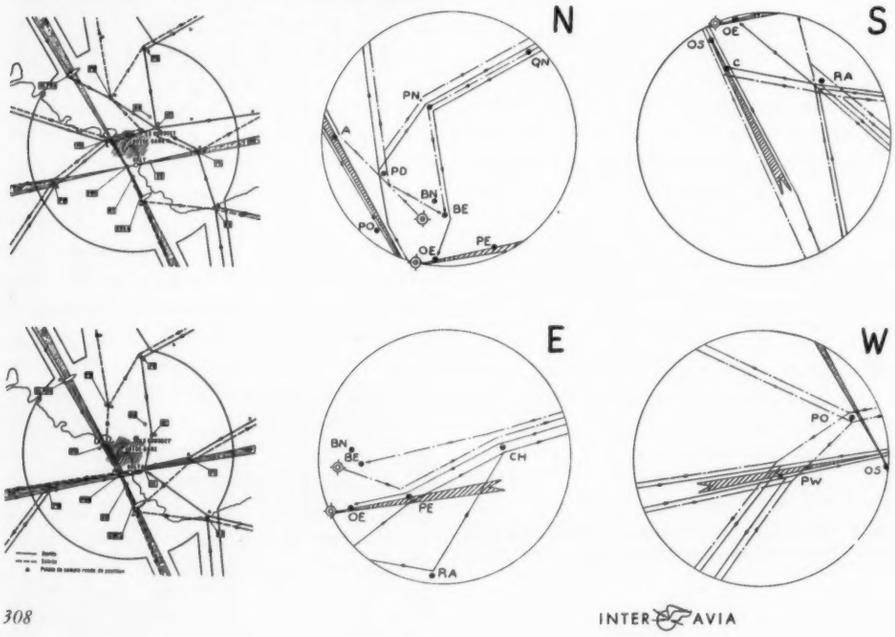
The above remarks show that the only information available to Area Control Centre staff is the *estimated* data supplied by the pilot. It is true that existing radio-electric equipment (MF radio beacons and MF radio ranges, VHF marker beacons, VOR stations and French Decca chain) enable aircraft to navigate accurately in terminal areas and along airways, and that careful research on ground equipment and navigation systems is in progress to arrive at a foolproof method of spacing aircraft itineraries. However these control systems are subject to human and other failures, for example, the complications arising if an aircraft's radio navigation equipments fails or operates unreliably. An Area Control Centre that did not have its own equipment for detecting aircraft would therefore be obliged to apply greater safety margins, which would slow down the flow of traffic. Moreover it would not be able to provide proper assistance to aircraft in difficulties.

It was for this reason that the French Secretariat General for Civil and Commercial Aviation decided in 1951 to equip the CCR/N with the most up-to-date means of radio detection, namely :

— long-range surveillance radar *(fig. 1)*,
— four automatic (cathode ray) VHF D/F installations.

The latter, built by S.E.T., were already in use at a number of airports. The former was developed by Compagnie Française Thomson-Houston to a specification issued by the Air Navigation Service and was put into operation at CCR/Nord in July 1953.

Fig. 5 : Diagram of sectors controlled by the six desks. Two left-hand pictures (north and south terminal areas) show entry and departure routes for Le Bourget and Orly respectively.



General technical characteristics

The surveillance radar can detect all aircraft of at least the size of the DC-3 up to a distance of 90 miles and an altitude of 32,000 ft.

Characteristics of the transmitter-receiver :

carrier frequency	2,700 to 2,900 mc/s
peak power	600 KW
pulse duration	1 microsecond
pulse frequency	900/sec
noise level, receiver	11 db
aerial revolutions	6 r.p.m.

The equipment has a device to eliminate permanent echoes. Two complete independent installations are provided, to ensure reliable service under all conditions.

There are six independent working desks in the control centre *(fig. 4)*, each controlling a different sector *(fig. 5)*.

*

As the installation of the radar equipment necessitated some alterations to the CCR/Nord premises, the Air Navigation Service decided to reorganize them completely, along with the adjacent Central Telecommunications Office. Both units have been housed at Orly since 1945, in a temporary single-storey building, and although a handsome modern building is planned for the future, it was still considered advisable to renovate the old premises to meet the new problems raised by the introduction of the radar equipment.

As part of this reorganization, it was decided to place the traffic controllers and the radar operators side by side in the same room.[1]

Special desks have been designed, each comprising :

— a board for posting progress slips ;
— a radar screen with adjustable inclination ;
— a telephone with 18 direct lines ;
— two VHF R/T sets with 8 frequencies.

The controlled zone is divided into six sectors, one for each desk. Special anti-glare lighting is used, and the room is soundproofed and air-conditioned.

Operating the radar

Having successfully completed a series of technical acceptance tests, the CCR/N's radar equipment was taken into experimental operation at the beginning of the year.

For some time it will be used only to supplement information on aircraft positions received by other means. Controllers using

[1] Apparently this is the latest theory in the United States and in London, although as far as is known, no control rooms have yet actually been arranged in this way.

progress slips will continue to exercise complete control over traffic, and the radar operator will be considered as an assistant. However, aircraft in distress will have the advantage of radar control under the best possible conditions up to the immediate approaches to a landing ground.

It is not yet possible to give responsibility for the control of air traffic to the radar operator, as primary radar [2] provides only a partial solution to the problem of acquiring full details on aircraft positions at any given moment. The radar screen shows only luminous pips which give no clue to the identity or the altitude of the aircraft producing them. Moreover, for reasons due to the propagation of the waves or the nature of the aircraft, the pip may disappear unexpectedly for a time.

The six-month period of experimental operation should prove that these difficulties can be overcome. Aircraft can be identified roughly by cathode ray D/F, and their identity confirmed when they fly over a reporting point. In case of doubt the pilot is asked to make a conventional manœuvre (left or right turn), which is then checked on the radar screen.

Until the Area Control Centre is provided with radar to measure altitude, details of the latter will continue to be obtainable only from the messages transmitted by aircraft and entered on their progress slips.

It is clear that the introduction of a complete radar procedure sets delicate problems of coordinating the work of the two controllers (radar and flight progress boards). Close cooperation must also be ensured between the controllers of each of the six sectors.

As soon as the controllers at CCR/N have sufficient experience, and procedures have been perfected, the radar equipment's full potential can be exploited (winter of 1954-1955). The standard spacing between aircraft could then be reduced to the so-called " radar spacing ". Aircraft taken under control at a great distance from Paris will be staggered before they arrive at the airport markers, so as to avoid stacking as far as possible. In certain conditions aircraft will be able to operate, under radar control, outside the airways.

*

The introduction of radar in congested terminal areas will give greater flexibility to the traffic control service and represent a first step towards the provision of the automatic equipment now under development.

[2] Primary radar is equipment which receives only the echoes reflected by the aircraft. A system of secondary radar comprises a receiver on the ground which receives powerful pulses transmitted by a responder in the aircraft triggered by the primary radar or an independent interrogator.

The Mind of Mr. Reader...

Dear Sir,

This is just a note to say how completely refreshing it is to find an aviation publication which will admit as you did in the April issue that its sources " are probably just as reliable or unreliable as any other source of information on Russian developments ". Entirely between us it is a great relief after the mystique of authority with which so many other publications surround their equally uncheckable revelations of what does—or does not—exist behind the Iron Curtain.

Montreal, Canada

(Name withheld by request.)

*

Dear Sir,

We have read the very interesting article in the January issue of *Interavia* about historical development of helicopters and autogiros. Pitifully, we did not find any sign of the Hungarian researches and helicopter designs.

We ask you—if possible—to make some public correction of the theme in your " Letters to the Editor " as follows :

As we know, the first helicopter in the world to fly was the Petróczy-Kármán observer helicopter in World War I. The craft was powered by three 120 h.p. Le Rhône engines driving two co-axial, two-bladed, contra-rotating rotors. It ascended to a height of 80 metres, and remained airborne for one hour. It was controlled by three cables from the ground.

The rotor designer of the Petróczy-Kármán observer helicopter, Mr. Oscar Asbóth, built, round a quarter of a century ago, four two-rotored two-bladed contra-rotating co-axial helicopters, powered by a rotating engine. The fourth of them became airborne first time on September 9th, 1928 in Budapest. The helicopter spent altogether more than 29 hours in the air, with more than 200 take-offs. The highest altitude reached by the craft was 30 metres, the longest distance 3 km, the highest horizontal speed 20 km/h.

We are happy to present to you the latest copy of the Hungarian paper " Repülés " (Flight), in which you can find further details of the helicopter and its flights, and some photos too.

The Royal Netherlands Aero Club (which financed Asbóth's research) owns a film about the helicopter and its flights.

" The Aeroplane " in its helicopter issue (January 9th, 1953) on pages 41 and 42 also mentions the Petróczy-Kármán and Asbóth helicopters, as pacemakers of helicopter development.

Sorry, our little nation has not had much success in the history of aviation, and—because of that—we should be very glad to see the requested corrections in *Interavia*, which is read the whole world over.

Budapest A. RAGYANSZKI
Editor, " Repülés "
Official Organ of the
Hungarian Flyers Association

It is generally recognised that the Bréguet-Richet was the first helicopter to lift a man, and Paul Cornu's design the first to make a free flight, both in 1907.

Dear Sirs,

My long experience of aviation (I was at the German aeronautical test centre of Rechlin from 1928 to 1945) warns me against the two-part cabin roof (*Interavia*, No. 3, 1954, page 159, picture of the *Vautour*). There will *always* be the danger that the " observer " will be killed by the front part of the roof while baling out.

Proposal : one-piece cabin roof, windscreen in front of observer, so that he can continue to read and operate his instruments even when the roof has been jettisoned.

The roof must be attached to the fuselage behind the observer in such a way that *premature* disconnection is not possible (at least at right angles to the aircraft's longitudinal axis).

I place my warning and my proposal freely at your disposal and should be happy if my words were heeded in time.

Munich-Grosshadern

PAUL SCHNELL
former Luftwaffe Engineer

*

Dear Sirs,

I have been reading your review for over 6 years now or so and have just renewed my subscription for the present year. During that time I have never, somehow, found the time or energy to send you a few words of appreciation. I like your review very much, I think it is one of the most serious magazines in and about aviation, and I think it was a very clever thing to do to break away from the normal habit of bringing out a magazine full of all sorts of things, as do the Americans and the British. I rather like to recline two evenings a month in a comfortable chair, light the pipe and set my mind to a fixed subject. Be it 'Helicopters', 'Aircraft Carriers', 'Rockets' or 'Air Freight'—there has not been one issue yet, which did not choose an interesting subject. And I would like to compliment you for it, I think you are doing a nice job. This country is a small and relatively inexperienced one at far as aviation goes, but I assure you that your review helps us along quite a bit in telling us about all kinds of aviation subjects.

So here goes, keep your nice work up and let us hope that the future will bring us many more issues of your interesting magazine.

Tel Aviv Steven E. STRUCK.

P. S. As I am employed by the National Flag Carrier, El Al Israel Airlines, and work in the Commercial Department, I know what I am talking about, and I am not handing out empty compliments.

*

Dear Sirs,

I have just been reading in the April issue of *Interavia* about what lawyers get away with...

But what, asks the astonished reader, will the newspaper world get up to next, when they are capable of quite simply turning the whole world back to front ?

Does my statement appal you ? I can prove what I say. Just look for yourselves at page 241 in the above-mentioned copy of *Interavia* !

Zurich Dr. Hans CASPAR.

The printers apologise for the topsy-turvy world and promise to put it back on the right track next month.

The Message Storage and Processing System

A NEW AIR TRAFFIC CONTROL AID

The new electronic " Message Storage and Processing System ", recently installed at the Civil Aeronautics Administration Technical Development and Evaluation Centre, Indianapolis, Indiana, may prove to be the outstanding contribution to the nationwide air traffic control plan being developed by the C.A.A. It receives, stores and evaluates flight plan and weather messages at very high speeds.

This equipment, designed for use at Regional Air Traffic Control centres — it is estimated that 12 to 15 installations can service all the major aircraft traffic centres in the United States — has been developed by *Remington Rand's* Engineering Research Associates Division at St. Paul, Minnesota. It automatically receives coded messages from several remote points by teletypewriter, examines these messages, performs certain clerical operations on them, files up to 2,000 such messages for split-second reference, locates any desired message and causes it to be typed out at one or more remote points. Finally, it discards or enters in legal storage any message no longer required.

Information on departure times, fuel loads, destinations, routes, payloads and other data contained in *flight plans* are transmitted over teletype to a revolving memory drum. The information is then compared — in less than half a second — with other flight plans already recorded on the drum's magnetic surface, and revised, cancelled, or brought up to date, according to the circumstances. The advantage of the magnetic drum system is the great speed and accuracy with which the information is received, compared, corrected and transmitted back to the sender.

Any number of stations can be accommodated by the equipment as long as the total storage capacity required does not exceed 2,000 messages and the traffic rate does not exceed 1,300 words per minute.

Basically, the equipment will

(1) store reference data on flight movements ;

(2) store complete flight plan data on all IFR flights with quick access available to all Air Traffic Control and other agencies ;

(3) provide automatic warning of discrepancies ;

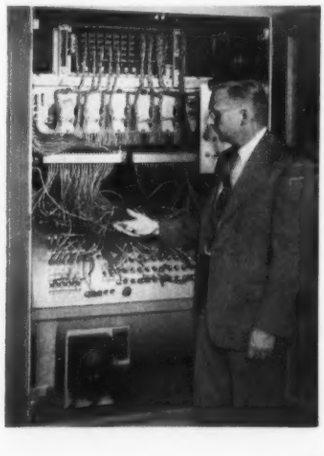
(4) indicate automatically when the proposed input to a terminal area is exceeding the acceptance rate, so that flow control may be exercised ;

(5) read out selected data to operations offices, air defence units, etc. ;

(6) warn automatically of possible emergency situations when a position report has not been received within a specified time after a flight has been estimated over a fix ;

(7) provide storage for computers and calculators to be used in air traffic control.

Perforated tape teletype (left) and supervisory desk of Remington Rand's Message Storage and Processing System.—The magnetic " memory drum " (right) for 2,000 flight plans and weather messages rotates at 1,190 r.p.m. and has 406 magnetic heads. Mr. J.L. Hill, engineer in charge of the development of the system, is seen holding one of the magnetic heads in his hand.



*

How the Message Storage and Processing equipment works is illustrated by the following example : A pilot planning to fly from *Rockford*, Illinois to *Missoula*, Montana, contacts the local weather bureau office at Rockford for forecasts for the route, for the destination airport and for several of the major airports en route. To obtain forecasts and weather reports for stations outside the local region the Rockford weather bureau transmits a message to the *Central* M.S.P. system. The weather data are automatically returned by the equipment and forwarded to the pilot — in about one minute.

The pilot then files a proposed flight plan (IFR) with the local Civil Aeronautics Administration INSAC specifying the identification and type of aircraft, his name, address and certificate number, the point of departure, altitude, and route to destination, the airspeed to be used, the proposed time of departure, estimated time of arrival, endurance and alternative airport. The Rockford INSAC forwards this flight plan message to the M.S.P. centre and to the Air Route Traffic Control centre.

The M.S.P. equipment automatically " reads the message ", to make sure it is " understandable ". Finding it to be complete and in proper form, the system searches all other flight plans already " on file " to make sure that a similar flight plan has not already been received. In this case the system files the flight plan and returns a message to Rockford saying " message received and filed ".

Meanwhile the Air Route Traffic Control centre prepares fixes for the control area and stores these in the M.S.P. equipment. Approximately ten minutes prior to the proposed departure the " automatic clock readout " of the equipment transmits these fixes to the control tower at Rockford and the sector controlling Rockford in the Air Route Traffic Control centre.

Clearance for the flight is issued, and this information is added to the flight plan in the M.S.P. equipment. Actual departure time is then added, and the estimated fixes are revised accordingly.

As the flight progresses, and the pilot reports on the fixes en route, his reports are also filed. The next two scheduled fixes ahead are transmitted automatically to the Air Route Traffic Control. If the controller desires additional fix postings ahead, he may transmit a " request " message to the equipment and the postings will be read out and displayed in less than one minute. — At the end of the flight Missoula tower transmits the arrival time and requests the M.S.P. equipment to file the completed flight plan in legal storage.

*

The M.S.P. equipment can also be used as a central reference file for weather information. Individual station observation reports can be collected from all over the country and the specific information required by a given user automatically selected and read out without loss of time.

*

There are six types of messages which the equipment can receive :

(1) *File ;*

(2) *Cancel ;*

(3) *Readout* — requests the equipment to read out a particular message from the drum storage ;

(4) *En Route or Refile* — requests the equipment to file a new or revised flight plan which is being submitted after departure ;

(5) *File Weather ;*

(6) *Readout Weather.*

The equipment accommodates messages of two lengths : 115 and 230 characters which are handled at a rate of 23,000 characters per second.

M.S.P. equipment contains some 1,900 vacuum tubes and requires 10 KVA of 230 Volt, 3-phase power for its electronic units. It is cooled by two 5-ton air conditioning units. The magnetic storage drum — the heart of the system — is 22 inches in diameter and 30 inches long, rotates at 1,190 revolutions per minute, and contains 406 magnetic heads.

Book Reviews

The Papers of Wilbur and Orville Wright. — Sponsored by Oberlin College, edited and prepared by Marvin W. McFarland, of the Aeronautical Division of the Library of Congress. McGraw-Hill Book Company, Inc., New York, Toronto, London, 1953. Two volumes, 1,278 pages. 254 photographs and numerous charts and diagrams. Price $25.

When the papers of the Wright Brothers were handed over to the Library of Congress, Marvin W. McFarland and one of his colleagues from the Library wrote in "The Library of Congress Quarterly Journal of Current Acquisitions" for August 1950 :

"The Wright-Chanute correspondence... is unquestionably among the most important, not to say fascinating, chapters in all of aeronautical literature and certainly of aeronautical history. It is seldom that mankind's epochal achievements on the history-making and history-changing scale of practical aerial flight have ever been recorded, discussed and elucidated with such clarity, candor and simple charm as are found in the Wright-Chanute letters..."

The above words apply with double force to the present masterly selection, which makes nearly a thousand documents from the Wright collection and 250 papers of Octave Chanute's available to a wider reading public. Thirty-three Wright Brothers diaries and note-books... their drawings of airframe, propellers and wind tunnel... the diary of Bishop Milton Wright, father of Wilbur and Orville... records of the Wright patent cases... there is not the smallest piece of paper that has not been examined. — The result is so striking that the reader inevitably wonders why this work was not begun until four years ago, why the Wright archives were not opened much earlier.

The answer is simple. Wilbur, the older brother, who died in 1912 at the age of 45, was the "writer", and nearly all the letters from the brothers to Octave Chanute were written by him. Orville, on the other hand, who lived to see the incredible evolution of powered flight, became increasingly reserved and reluctant either to edit the papers himself or to permit them to be handled by a possibly unsympathetic editor. Thus the papers did not become available until some time after Orville's death, and the aviation world had to wait — despite the official Wright biography by Fred C. Kelly — until the beginning of 1954 for the information contained in "The Papers of Wilbur and Orville Wright".

He.

Luftfahrt-Wörterbuch/Aviation Dictionary. — By Roderich Cescotti ; Hanns Reich Verlag, Munich 1954 (German-English and English-German ; with list of abbreviations ; 448 pages ; price DM 13.80)

Of handy pocket size — thin paper and flexible thermoplastic cover — this English-German dictionary (which can really be put in a jacket pocket) of roughly *30,000 words* will be welcomed by scientists, engineers and translators, especially in German-speaking countries where it will provide an indispensable "open Sesame" to the international aviation language (English). In addition to the main German-English and English-German sections (the latter including international phonetic spelling), it contains a list of roughly *1,000 abbreviations*, nearly *100 GCA R/T phrases* and the most important conversion factors for metric and English measures.

Ri.

Raketenantriebe, by Joseph Stemmer, with contributions by Dr. E. Sänger and Dipl. Ing. H. Gartmann. — Schweizer Druck und Verlagshaus AG., Zurich 1952. (523 pages ; 215 illustrations, 27 tables ; price Fr. 19.75 ; German).

The task which the authors set themselves, and in which they have admirably succeeded, is to give a readily understandable introduction to the problems of rocket power and of rocket and space travel. Stemmer begins by giving a broad survey of the historical development of rockets, and then discusses propellants, tabulating the essential data on solid and liquid propellants, both those in use today and those likely to be employed in future rocket engines.

Following chapters on modern powder rockets (take-off rockets, rocket projectiles, anti-aircraft rockets etc. ; table of World War II powder rockets) and the basic problems of high-speed and high-altitude flight with special reference to rocket bodies, substantial space is devoted to rocket motors for liquid propellants. Starting from the general structure of such motors, the author goes on to discuss processes in the combustion chamber, propellant atomization, processes in the nozzle, cooling problems, propellant feed, structural materials. Here again the text is supplemented by photographs, drawings and tables of the most important heat-resisting materials. Reference should also be made to the examples given of test installations and the descriptions of practical flying equipment with rocket engines, from the smallest up to the biggest long-range rockets and pilotless aircraft yet built. In the final chapter the author then goes over to his own special domain of space travel.

Stemmer's object is to initiate a broad circle of readers into the secrets of rocket propulsion and space travel. At the same time his book should by no means be scorned by the expert. The mass of design details and data collected in its 523 pages make of it one of the most comprehensive reference works on rocketry that has ever been published in the German language.

Airplane Design. — By Gerald Corning, Associate Professor, University of Maryland. — — Published by the University (College Park Maryland), 1953. (English : 295 pages plus 22-page supplement of sample calculations).

The author sets out to show "how it's done", how a modern aircraft design takes shape from a definite set of specifications. His book is divided into three parts : Part I, Aerodynamic Design ; Part II, Stability and Control ; Part III, Directional and Lateral Stability and Control, and Maneuvering Flight. *Part I* describes the methods available to the designer to meet his customers' wishes. Although chief attention is given to jet aircraft, a brief outline is also added of design calculations for propeller-driven types. *Part II* gives theoretical rules for stability and controllability, and *Part III* shows how air and ground loads are ascertained under United States Civil Air Regulations and distributed among the airframe components. — Of particular interest are the sample calculations for a 40-seat jet transport with a range of 2,000 miles, a cruising speed of 500 m.p.h. and using a runway length of 6,000 ft. — Many tables and drawings, list of symbols, index.

Ri.

L'Aéroport de Paris. — By Claude Postel, Librairie Armand Colin (Cahiers de la Fondation Nationale des Sciences Politiques, No. 49). Paris 1953. (French ; 190 pages ; with plates, diagrams and tables ; 650 francs).

This book was developed from a thesis written in 1952 and is thus based on the situation of 1951. Hence the whole section dealing with traffic at Paris Airport is out of date. This is a pity, as the rest of the book is of real interest, particularly the last part which discusses one of the most topical and difficult problems raised by the existence side by side of several different modes of transport, that of coordinating investment, first on a national and then on a European level.

A new edition of this book, revised and brought up to date, would be of service to those concerned with the economic problems of aeronautical ground organization both in France and elsewhere.

Rn.

Der Modellflug, by Alfried Gymnich.—Carl Lange Verlag, Duisburg 1953/54 (German, 208 pages, price DM 8.90).

Alfried Gymnich, well-known writer on aircraft model building and editor of the periodical "Der Modellflugbau", gives here an introduction to and a survey of the wide and interesting field of aircraft modelling. A book for the young, entertaining but instructive, with the easily written text enlivened and illustrated by a large number of drawings and photographs. Special mention should be made of the "Model Building ABC", which gives an introduction into all model flying questions, and the small German-English and English-German glossary of special terms.

Ba.

Fliegergeschichten (Vols. 1 to 6). Authors up to date : Streit, Henn, Pirner ; issued by Dr. Peter Supf ; Verlag Arthur Moewig, Munich (German ; 32-40 pages each volume ; price DM 0.50 each).

A series of stories for aviation enthusiasts, particularly schoolboys : pioneering feats, wartime experiences etc. The publishers state that the series covers the whole range of flying and is intended to popularize aviation. The series is to be continued.

Ri.

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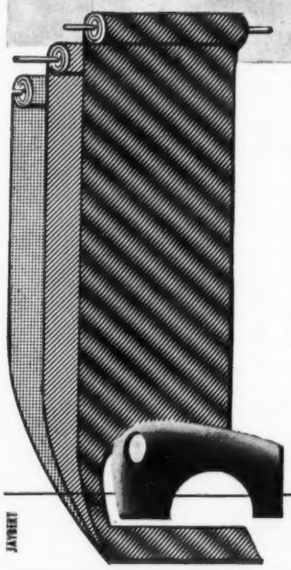

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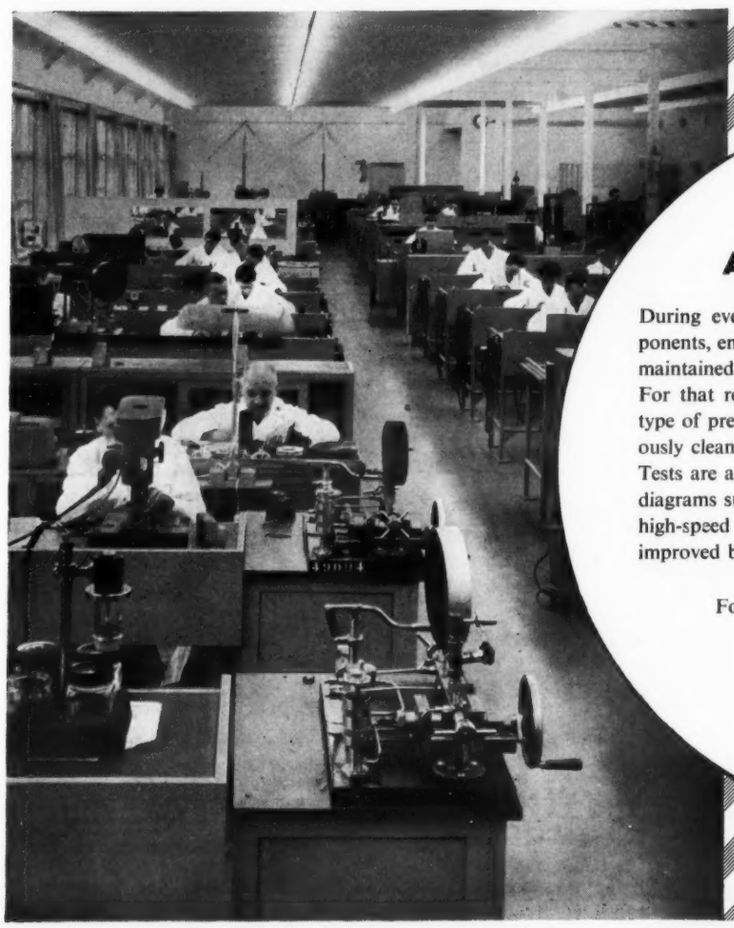

ACCENT ON ACCURACY

During every stage of repair and inspection of aircraft components, engines, accessories and instruments, highest accuracy is maintained as a standard practice in KLM's Technical Division. For that reason the instrument shop (see picture) where every type of precision-made flight instrument is examined, is scrupulously clean, air-conditioned, humidity controlled and dustproof. Tests are automatically controlled by recording instruments and diagrams supplied with each overhaul, and many an item of the high-speed equipment operates with the extra benefit of being improved by KLM's own engineers.

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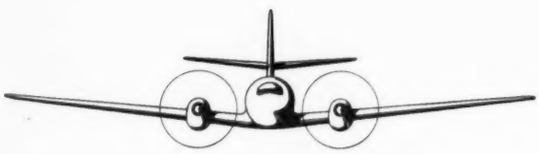

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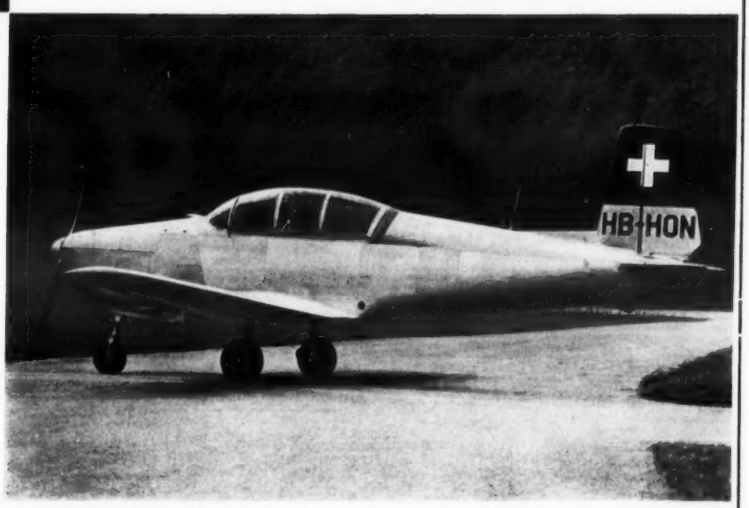

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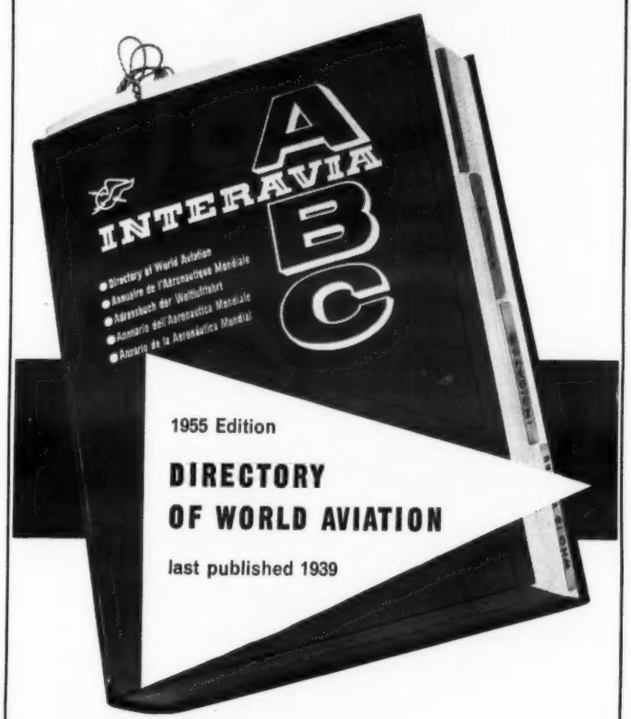

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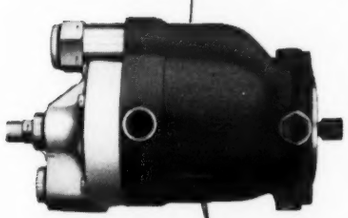

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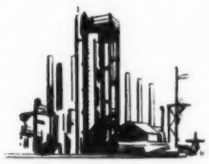

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